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OUR TWO BRAINS.

By Richard A. Proctor.

(*Continued from p.* 355.)

AMONG the arguments adduced by Dr. Wigan in favour of his theory of the duality of the brain is the "sentiment of pre-existence" which most of us have recognised. Dr. Wigan says that he has never met a person who had not experienced it more than once; and, though I believe there are a few who know nothing of it, nearly every one when the sentiment is described recognises it as one with which he is more or less familiar. It is a sudden feeling, as if some scene just witnessed had been presented before in all its details, with "the same speakers, seated in the same positions, saying the same words, and uttering the same sentiments." As Dr. Wigan remarks, "the postures, the expression of countenance, the gestures, the tone of voice, all seem to be *remembered* and to be now attracting attention for the second time: *never* is it supposed to be the *third* time."

The attempt has more than once been made to explain the phenomenon we are considering as merely the reproduction of some early and all but forgotten impressions of a scene more or less resembling the one actually before us at the moment when the sensation is experienced. But no one who rightly apprehends the nature of this "sentiment of pre-existence" can for a moment adopt such an explanation as this. When experienced in its full force it always presents the person himself who experiences it as of the same mental capacity, with the same ideas, the same views, as at the moment when the phenomenon is noticed. In what seems a recollection, he sees such and such persons around him as persons familiar to him, he hears their words, notices their actions, and (so far as the suddenness of the conception will permit) considers their conduct, as he would only do at the particular part of his life which he has actually reached. It *can* be no recollection of long-past events; for at no long-past part of his life had he such persons among his friends, or such ideas and views as to them and their actions. Or it may be that events are in progress which cannot possibly have occurred before in the experience of the person who yet seems to recollect them. It is absurd to refer such cases to the recollection of events which had happened in early infancy.

As an illustration of the weakness of this explanation, I quote an interesting case, on which great stress was laid in the article to which I refer; it is taken from Dr. Carpenter's valuable work on "Mental Physiology":—"Several years ago," he says, "the Rev. S. Hansard was doing clerical duty for a time at Hurstmonceaux, in Sussex; and while there, he one day went over with a party of friends to Pevensey Castle, which he did not remember to have ever previously visited. As he approached the gateway, he became conscious of a very vivid impression of having seen it before; and 'he seemed to himself to see,' *not only the gateway itself, but donkeys beneath the arch and people on the top of it.* His conviction that he must have visited the castle on some former occasion,—although he had neither the slightest remembrance of such a visit, nor any knowledge of having ever been in the neighbourhood previously to his residence at Hurstmonceaux,—made him inquire from his mother if she could throw any light on the matter. She at once informed him that being in that part of the country when he was about *eighteen months* old, she had gone over with a large party, and had taken him in the pannier of a donkey; that the elders of the party having brought lunch with them, had eaten it on the roof of the gateway where they would have been seen from below, whilst he had been left on the ground with the attendants and donkeys." "This case," adds Dr. Carpenter, "is remarkable for the vividness of the sensorial impression (it may be worth mentioning that Mr. Hansard has a decidedly artistic temperament) and for the reproduction of details which were not likely to have been brought up in conversation, even if he had happened to hear the visit itself mentioned as an event of his childhood, and of such mention he has no remembrance whatever."

Here is undoubtedly an interesting case of early recollection suggesting to a person in a particular place that he had been there before. In this case the remarkable gateway of Pevensey Castle recalled the time when the gateway had last been seen; but so far back was that time that no circumstances not immediately related to the aspect of the gateway were recalled, nor could the observer tell to what part of his past life his "recollection" had gone back, though he felt assured he had himself witnessed what he recalled. In other words the only "sentiment of pre-existence" in question was the familiar idea that he had existed for some time before. Beyond the early age to which Mr. Hansard's recollection went back, his remembrance of the gateway has no more scientific interest, and certainly has no more bearing on "the sentiment of pre-existence," than has young John's remembrance in the "Professor of the Breakfast Table" that he had often in his past life been occupied as he was at that moment,—to wit, smoking a cigar. As might be expected too, in every case of mere recollection, details not actually present when remembrance was brought back, came as vividly before Mr. Hansard as the gateway itself. He saw with his mind's eye *not* the scene before him but another scene: what has to be explained is the sudden and vivid perception that the very same sights and sounds seen and heard at the moment had been seen and heard before, as if in some previous state of existence.

Still less available is the dream theory which Dr. Carpenter himself seems to favour. He says that most persons, however unimaginative they may be, have noticed the reproduction of ideas which have previously only passed through the mind in dreams; "for," he goes on, "almost every one has had occasion, at some time or other, to say,

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'Did this really happen or did I dream it?'" He cites a remarkable case of a lady known to him who seemed entirely unable to distinguish between her dreaming and waking experiences. But the "sentiment of pre-existence" is more precise than any mere dream recollections, and is always directly associated with some actual scene and with a series of events actually in progress when it is momentarily excited.

I will take as an illustration of this remarkable mental phenomenon the last occasion when it presented itself in my own experience:—

I was watching for the first time in my life one of those remarkable political processions with which Americans amuse themselves as the time for a presidential election draws near. Before me were passing a number of men and boys on horseback, bearing torches, and occasionally giving vent to that singular noise—something between a squeak and a catcall—which does duty in America for a hurrah. I was rather wearied with the noise and turmoil, and had ceased to pay attention to the proceedings. Suddenly a band of men forming what they call in America a "shot-gun brigade," came along, and as they passed my house (which my American kinsfolk, who have strong political sympathies, had illuminated), they fired several volleys, which roused me from my reverie. Suddenly it appeared to me that at some remote time—thousands of years ago—all that was then passing had been experienced before. The same procession in every detail had passed before me, lit up by the same glow from an illuminated house behind; my wife and children had at that remote time stood beside me as they stood beside me now. Persons whose acquaintance I had only made a few weeks before were there *then*—thousands of years ago—even as *now*: and stranger still, if the matter be thought of a little, I had had the same views about the events in progress and the persons standing by me, then as at the moment of time when this sentiment of pre-existence took possession of my mind.

No one who has ever seen an American procession, especially in the Far West, will for a moment imagine that I was deceived by the remembrance of some procession I had seen in England, for there is no resemblance—especially in the matter of that most objectionable "shot-gun brigade," at the thought of which my ears still tingle. Then I have seen no torchlight procession since I was a boy, and when I watched such a procession as a boy I had not, to the best of my recollection, an American lady—my wife—beside me, nor children of my own around me, nor assuredly was a boy of mine disporting himself, as on this occasion, with an American torch (quite unlike our English ones). Yet, again, I rather enjoyed the noise and confusion of the English procession, being but a boy myself, and therefore necessarily in the savage stage of existence. I certainly had not then the idea which filled my mind at the moment when "the sentiment of pre-existence" came upon me, that all such demonstrations—all waving of lights, and yelling of shouts, and beating of drums, and firing of guns—are fit only for people passing through the savage stage of their existence, whether as individuals or as a nation. Yet everything belonging to the scene before me, and everything belonging to my own conscious individuality at the moment, was presented as part of an experience belonging to an indefinitely remote past.

I know of no explanation of this sentiment of pre-existence which has the least semblance of fitness to account for the phenomena but that which Dr. Wigan has advanced. He notes first, what I believe is in the experience of all, that "the delusion occurs only when the mind has been exhausted by excitement, or is from indisposition or any other cause languid. The persuasion of the scene being a repetition, comes on when the attention has been roused by some accidental circumstance, and we become as the phrase is 'wide awake.'" "I believe the explanation to be this," he proceeds: "only one brain has been used in the immediately preceding part of the scene,—the other brain has been asleep, or in an analogous state nearly approaching it. When the attention of both brains is roused to the topic, there is the same vague consciousness that the ideas have passed through the mind before, which takes place on reperusing the page we had read while thinking on some other subject. The ideas *have* passed through the mind before, and as there was not sufficient consciousness to fix them in the memory without a renewal, we have no means of knowing the length of time that had elapsed between the *faint* impression received by the single brain, and the *distinct* impression received by the double brain. It may seem to have been many years." In my own case it invariably seems to exceed enormously the whole of my past life.

Dr. Wigan gives an example in his own experience which is akin in some respects to the one I have just cited, especially in being inconsistent with all explanations which have been advanced respecting this interesting mental phenomenon, and so far as I can see, with any conceivable explanation, other than that which regards the phenomenon as depending on the duality of the brain. He was present at the funeral of the Princess Charlotte an occasion of so remarkable a kind (if we consider the circumstances attending that Princess's death, and the feelings excited by the event) that assuredly none will suppose he had ever had a similar experience:—"I had been standing four hours," he says, "and on taking my place by the side of the coffin, in St. George's Chapel, was only prevented from fainting by the interest of the scene. All that our truncated ceremonies could bestow of pomp was there, and the exquisite music produced a sort of hallucination. Suddenly, after the pathetic 'Miserere' of Mozart, the music ceased, and there was an absolute silence. The coffin, which was placed on a kind of altar covered with black cloth (united to the black cloth which covered the pavement), sank down so slowly through the floor, that it was only in measuring its progress by some brilliant object beyond it that any motion could be perceived. I had fallen into a sort of torpid reverie, when I was recalled to consciousness by a paroxysm of violent grief on the part of the bereaved husband, as his eye suddenly caught the coffin sinking into its black grave, formed by the inverted covering of the altar. In an instant I felt not merely an *impression*, but a *conviction*, that I had seen the whole scene before on some former occasion, and had heard even the very words addressed to myself by Sir George Naylor."

(*To be continued.*)

RAMBLES WITH A HAMMER.

By W. Jerome Harrison, F.G.S.

GEOLOGY OF CRICCIETH AND PWLLHELI (*continued*).

III.

THE CAMBRIAN FORMATION.—Strata of Cambrian age—the first rocks which yield us evidences of life in the form of fossils—occur in the east and in the west of our district. In the west of Carnarvonshire the lowest Cambrian beds there exposed—the Lingula Flags—form the promontory which extends southward of Abersoch and Llanengan. Taking the mail-car from Pwllheli to the

former village, we walk across the sandhills which fringe the beach to the rounded moorland ridge of Penrhyn-ddu, where St. Tudwal's twin isles lie at our feet, their rocks being an extension of those of the mainland. Walking southwards along the precipitous cliffs, the little bay of Porth-Ceiriad is soon reached. Here the Lingula Flags* form magnificent cliffs 350 ft. in height, the rocks dipping to the east at an angle of 45 deg.; in the middle of the bay they have been eroded down to the sea-level, and the hollow so formed is filled by a great mass of boulder clay rising perpendicularly 80 ft. or 100 ft. above the shore (Fig. 1).

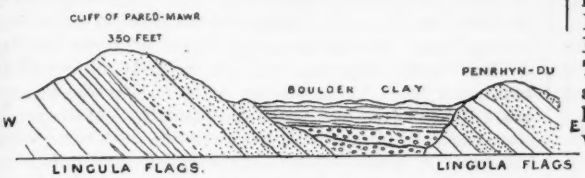


Fig. 1.—Section in Bay of Porth-Ceiriad. Lingula Flags form cliffs on the east and on the west; the hollow between being filled up by glacial deposits.

The stratified Cambrian rocks here consist of hard micaceous sandstones (ripple-marked and showing worm-tracks on the surfaces) with dark-grey and black slabs. Similar beds extend westwards as far as the broad bay called "Hell's Mouth," whose low shore is marked by a little cliff of boulder-clay and fringed by green fields which, smiling in the summer-sun, belie the ominous name. But woe to the sailing-vessel which gets becalmed between its two projecting headlands! Strong currents set towards the beach, and the projecting ribs and timbers of wrecked ships mark their fatal effect. A little girl, who acted as my guide, told me that sealed bottles which had been thrown overboard from ships in peril were not uncommonly found on the shore of Hell's Mouth, and I saw in a cottage a number of West Indian seeds picked up there. In the absence of fossils, the hard grits and shales—1,200 feet in thickness—which we have just described, were long considered to belong to the *Harlech Series*, which lies at or near the base of the Cambrian formation. But, in 1876, Professor Ramsay found specimens of the trilobites *Agnostus* and *Olenus*, with the little brachiopod shell *Lingulella lepis* in roadside quarries near Porth-Ceiriad; and as these fossils are peculiar to the Lingula Flags, this fortunate discovery at once settled the question of the true age of the strata.

Passing now to the north-east from Abersoch, through Pwllheli, it is a distance of fifteen miles before we reach the Lingula Flags, in the east of our district, where they mantle round the hill called Moel-y-gest, whose profile is a gigantic Wellington *silhouette*. Here the whitish flaggy sandstones form successive step-like terraces at the western foot of the hill, whence they run down to the coast at Ogof-ddu, about a mile east of Criccieth. Their thickness here is above 2,000 ft, forming a dome-shaped mass, of which the northern half only is visible. The sandy beds are surmounted by black slates, and there are black slates underneath them also, in which the caves at Y-graig-ddu—the Black Rock—have been hollowed out. Fossils are numerous, but not easy to find or to extract; the best localities are Ogof-ddu, Penmorfa Church, Carreg-wen, and Borth (south-west of Portmadoc).

* This name is derived from the abundance of the brachiopod shell *Lingula* (now *Lingulella*) Davisii, discovered by Mr. Davis in 1845.

The *Tremadoc Slates* lie above the Lingula Flags, between Portmadoc and Criccieth, but they decrease in thickness from 3,000 ft. near the former, to 200 ft. near the latter, town, and they probably die out altogether further west, for there is no trace of them above the Lingula Flags south of Abersoch. They derive their name from the pretty little town of Tremadoc—which, in its turn, was christened after its founder, a Mr. Madocks, who flourished as a notable land-reclaimer in this region, at the close of the last century.

It is not possible for me to leave the Cambrian beds of Carnarvonshire without acknowledging the great services rendered in the study of these rocks by Messrs. David Homfray and Ash, of Portmadoc, to the former of whom I am personally indebted for guidance and information. The late Mr. Salter did some of his best work down here, about 1860; but the main relations of the different beds had been ascertained by Sedgwick some ten years previously.

Lower Silurian Formation.—The junction of the great Cambrian and Silurian formation is marked by a bed of grit, well seen at Garth Hill, near Portmadoc, but only 10 feet thick where it runs out to sea at Ogof-ddu, east of Criccieth. This grit forms the base of the *Arenig Group*, which consists mainly of iron-stained black slates, containing beds of pisolitic iron ore and a large collection of fossils—the *graptolites* being especially numerous and noteworthy. Arenig Rocks also occur in the western tract, between Abersoch and Llanengan. Here they dip northwards, and are separated from the Lingula Flags beneath by a line of fault, whose direction, east and west, can be clearly traced by the line of chimneys marking the numerous lead-mines; for the "fault" has been filled up with (among other things) much galena (sulphide of lead) deposited by the heated water which traversed the line of weakness, resulting from the severance of the rocks. The rubbish heaps and heaps of picked ore surrounding the mouths of the shafts of the lead-mines form a fine collecting-ground for the mineralogist. The pisolitic iron-ore, by which the Arenig strata can be best recognised in this western portion of Carnarvonshire, is only known to occur at one other place in Lleyn, viz., at Trwyn-y-tâl, on the coast, about a mile north-west of Yr Eifl.

If it be asked why the line of demarcation between two great geological series is drawn at the base of the Arenig Beds, the answer is to be found in the great change which there takes place in the *fossils*—the remains by which we judge of the life of the period. No fewer than fifty-five new genera of animals make their first appearance in the Arenig Beds, including the remarkable fossils called graptolites, which Prof. Lapworth has shown to be so useful as marking by distinct species distinct beds of rock, and so enabling us to identify the order of succession among strata which may be hundreds of miles apart.

The Arenig Beds are also interesting, because they tell us of the volcanic action on a grand scale which took place during the time of their deposition. In the Arenig Mountains, the Arans, Cader Idris, and elsewhere, we find the Arenig slates interbedded with enormous masses of old lava and beds of volcanic ashes. In the district we are now describing, a bed of igneous rock of this age forms the top of Moel-y-gest, and constitutes the grand precipices north of that hill between Tremadoc and Brynkir (Fig. 3). On the Survey Map it is styled *greenstone*, a name which now means nothing save that *some* igneous rock is meant. Modern petrologists would call the Moel-y-gest rock an ancient basalt.

(To be continued.)

DREAMS:

THEIR PLACE IN THE GROWTH OF PRIMITIVE BELIEFS.

By Edward Clodd.

CONCLUSION.

REFERENCE has now to be made to the part played by dreams as supposed channels of communication between heaven and earth; as portents, omens, &c. The common belief among the nations of antiquity that they were sent by the gods, and the like belief lurking in the minds of the superstitious to this day, are the scarcely-altered survivals of barbaric confusion respecting them.

When man had advanced from the earlier stages of undefined wonder and bewilderment concerning the powers around and above him to anthropomorphic conceptions of them, *i.e.*, to making them in his own image, the events of his dreams were striking confirmation of his notions about the constant intervention of spiritual beings, gods, chiefs, and ancestors, in the affairs of life. That personal life and will with which the rude intelligence invests the objects of its awe; waving trees, swirling waters, drifting clouds, whirling winds, stately march of sun and star, seemed especially manifest in dreams and visions. In their unrelated and bewildering, or, on the other hand, their surpassingly clear incidents, the powers indwelling in all things seemed to come nearer than in the less sensational occurrences of the day, uttering their monitions, or making known their will. They were the media by which this and that thing was commanded or forbidden, or by which guidance and counsel and knowledge of the future were given. To induce them, therefore, became a constant effort. The discovery that fasting is a certain method of procuring them is one reason of its prevalence in the lower culture. Amongst all the indigenous races of North America abstinence has been practised as a chief means of securing supernatural inspiration. It is believed that whatever is seen in the first dream thus produced by fasting becomes the manitou, or guardian spirit of life, corresponding to the "daimon" of Socrates. And whoever by much fasting is favoured with dreams, and cultivates the art of explaining them as bearing on the future, becomes the feared and consulted "Medicine Man" of his tribe. His *kee-keé-wins*, or records, are finally shown to the old people, who meet together an consult upon them. They in the end give their approval, and declare that he is gifted as a prophet, is inspired with wisdom, and is fit to lead in the councils of the people.*

Very slender data were needed for the conclusions first drawn from dreams; let the death of a friend or foe be the incident and the event happen; let a hunting-path fill the half-torpid fancy and a day's fasting follow; let the mother of a young sportsman dream that she saw a bear in a certain place, and the son, guided by her account, find the bear where indicated, and kill it, the arbitrary relation is set up forthwith. As Lord Bacon says, "Men mark the hits, but not the misses," and a thousand dreams unfulfilled count as nothing against one dream fulfilled. Out of that is shaped, as dream-lore shows, a canon of interpretation by which whole races will explain their dreams, never staying, when experience happens to confirm it, to wonder that the correspondences are not more frequent than they are. Where the arbitrary act was wrought, the isolated or conflicting influences manifest, there deity or demon was working. So the passage from the crude interpretation of his dreams by the barbarian to the formal elaboration of the dream-oracle is obvious. It was only one of many modes by which the gods were thought to hold converse with man, and by which their will was divined. It was one phase of that many-sided belief in power for good or evil inhering in everything, and which led man to see omens in the common events of life, in births, in the objects anyone met in a journey or saw in the sky; to divine the future by numbers, by the lines in the hand, by the song and flight of birds (lurking in the word *augury*), by the entrails of sacrificed men and animals.* Sometimes the god sends the message through a spiritual being, an angel (literally "messenger"); sometimes he, himself, speaks in vision, but more often through the symbolism of both familiar and unfamiliar things. To interpret this is a serious science, and skill and shrewdness applied therein with success were passports to high place and royal favour. In this, we have the familiar illustrations of Joseph and Daniel, and, indeed, we need not travel beyond the covers of the Old and New Testaments for abundant and varied examples of the importance attached to dreams and visions, and of the place accorded to dreams,† an importance undiminished until we come to the literature of the centuries just before Christ. For example, in the Book of Jesus the Son of Sirac, we read—

> Vain and deceitful hopes befit the senseless man,
> And dreams make fools rejoice.
> Like one who grasps at a shadow and chases the wind,
> Is he who puts trust in dreams.‡

In the belief that through dreams and oracles Yahweh made known his will, the influence of older beliefs and their literature is apparent. Among the Accadians, a pre-Semitic race in Babylonia, there existed a mass of treatises on magic and divination by dreams and visions, and both from this and from Egyptian sources, blended with survivals from their barbaric past, the Hebrews largely drew.

In this, too, "there is nothing new under the sun." Homer, painting the vividness and agonising incompleteness of the passing visions, affirms that dreams from Jove proceed, although sometimes to deceive men; Plato assigns prophetic character to the images seen in them; Aristotle sees a divination concerning some things in dreams which is not incredible; the answer to oracles was sought in them, as when the worshipper slept in a temple on the skin of a sacrificed ram, and learned his destiny through the dream that came. The Stoics argued that if the gods love and care for men and are all-knowing, they will tell their purposes to men in sleep. Cicero attaches high importance to the faculty of interpreting them; their phenomena, like those of oracles and predictions should, he contends, be explained just as the grammarians and the commentators explain the poets.

With the influence of these beliefs in the air, and with the legend-visions of Scripture as authority, the divine origin of dreams became a doctrine of the Christian Church. Tertullian says that "we receive dreams from God, there being no man so foolish as never to have known any dreams come true," and in his *De Anima* reference is made to a host of writers of dream treatises. For the most part they are but names; their treatises have perished, but enough

* The following Mohammedan recipe for summoning spirits is given in Kunzinger's "Upper Egypt." "Fast seven days in a lonely place, and take incense with you, such as benzoin, aloes-wood, mastic, and odoriferous wood from Soudan, and read the chapter 1,001 times (from the Koran) in the seven days—a certain number of readings, namely, for every day one of the five daily prayers. That is the secret, and you will see indescribable wonders; drums will be beaten beside you, and flags hoisted over your head, and you will see spirits full of light and of beautiful and benign aspect."

* In Roger's *Thesaurus*, Sect. 511, a curious and instructive list of terms expressive of the different forms of divination is given.

† Numbers xii. 6; I. Samuel xxviii. 6, 15, &c.

‡ Ch. xxxiv.

remains for the perusal of the curious regarding ancient rules of interpretation and the particular significance of certain dreams. The current views of dreams in classic antiquity are believed to be partly embodied in the 'Ονειροκριτικα' of Artemidorus of Ephesus, who flourished about the middle of the second century, and who reduces dream interpretation to a body of elaborate rules, while amongst Christian writers Synesius of Cyrene, who lived two centuries later, holds a corresponding place.

Both classic and patristic writers supply copious details concerning the classes into which dreams were divided, and which have some curious correspondences among the Oriental nations, as well as in our dream-lore: *e.g.*, when Artemidorus says that he who dreams he hath lost a tooth shall lose a friend, we may compare with this a quotation which Brand gives from the "Sapho and Phao" of Lily, a playwright of the time of Elizabeth. "Dreams have their trueth. Dreams are but dotings, which come either by things we see in the day or meates that we eat, and so the common-sense preferring it to be the imaginative. 'I dreamed,' says Ismena, 'mine eyetooth was loose, and that I thrust it out with my tongue.' 'It foretelleth,' replies Mileta, 'the loss of a friend; and I ever thought thee so full of prattle that thou wouldst thrust out the best friend with thy tatling.'"

It is, however, needless to quote from Artemidorus and others of their kin. They do but furnish samples of the ingenuity applied to profitless speculations on matters which were fundamental then, and around which the mind played unchecked and unchallenged. Moreover, the subtle distinctions made between dreams in former times were slowly effaced, or sank to their proper level in the gossip of chap books—our European *kee-keé-wins*. But the belief in the dream as having a serious meaning, and in the spectral appearances in visions as real existences, remained as strong as in any barbarian or pagan. In an atmosphere charged with the supernatural, apparitions and the like were matters of course, the particular form of the illusion to which the senses testified being in harmony with the ideas of the age. The devil does not appear to Greek or Roman, but he sorely troubled the saints, unless their nerves were, like Luther's, strong enough to overmaster him. Luther speaks of him as coming into his cell, and making a great noise behind the stove, and of his walking in the cloister above his cell at night; "but as I knew it was the devil," he says, "I paid no attention to him, and went to sleep." Sceptics now and again arose protesting against the current belief, but they were as a voice crying in the desert. One Henry Cornelius Agrippa, in the fifteenth century, a man born out of due time, says, "To this delusion not a few great philosophers have given not a little credit, especially Democritus, Aristotle, Sinesius, &c., so far building on examples of dreams, which some accident hath made to be true, that thence they endeavour to persuade men that there are no dreams but what are real."

His words have not yet lost their purport. For the credulity of man, the persistence with which he clings to the shadow of the supernatural after having surrendered the substance, seem almost a constant quantity, varying only in form. Unteachable by experience, fools still pay their guineas to mediums to rap out inane messages from the departed, and send postage stamps to the Astronomer Royal, asking him to "work the planets" for them, and secure them luck in love and law-suits. Nor is there any cure for this but in wise culture of the mind, wise correction, and wholesome control of the emotions. By faithfully intending the mind to the realities of nature, as Bacon has it, and by living and working among men in a healthy, sympathetic way, exaggeration of a particular line of thought or feeling is prevented, and the balance of the faculties best preserved. For, adds Dr. Maudsley,* in pregnant and well-chosen words, "there are not two worlds—a world of nature and a world of human nature—standing over against one another in a sort of antagonism, but one world of nature, in the orderly evolution of which human nature has its subordinate part. Delusions and hallucinations may be described as discordant notes in the grand harmony. It should, then, be every man's steadfast aim, as a part of nature—his patient work—to cultivate such entire sincerity of relations with it; so to think, feel, and act always in intimate unison with it; to be so completely one with it in life, that when the summons comes to surrender his mortal part to absorption into it, he does so, not fearfully, as to an enemy who has vanquished him, but trustfully, as to a mother who, when the day's task is done, bids him lie down to sleep."

NOTE.—The papers now concluded, as also the former series on the "Birth and Growth of Myth," will, with the Editor's permission, and after revision and additions, be shortly published in one volume under the title of "Myths and Dreams." The series of papers on "Evolution" already announced will, it is hoped, be commenced at an early date.

DICKENS'S STORY LEFT HALF TOLD.

NOW that Mr. Foster has explained his theory at length, I should like to reply, as briefly as possible, to some of his arguments.

In my former letter (1343) I quoted from the *Century Magazine*, to show that Mr. Fildes' opinion was that Jasper murdered Edwin Drood. The following extract is taken from Forster's "Life of Dickens," which I have not till lately read, viz.:—

"The story, I learnt immediately afterward, was to be that of the murder of a nephew by his uncle; the originality of which was to consist in the review of the murderer's career by himself at the close, when its temptations were to be dwelt upon as if not he the culprit, but some other man, were the tempted. The last chapters were to be written in the condemned cell, to which his wickedness, all elaborately elicited from him as if told by another, had brought him. Discovery by the murderer of the utter needlessness of the murder for its object, was to follow hard upon commission of the deed; but all discovery of the murderer was to be baffled till towards the close, when by means of a gold ring which had resisted the corrosive effects of the lime into which he had thrown the body, not only the person murdered was to be identified, but the locality of the crime and the man who committed it. So much was told to me before any of the book was written; and it will be recollected that the ring taken by Drood to be given to his betrothed only if their engagement went on, was brought away with him from their last interview. Rosa was to marry Tartar, and Crisparkle the sister of Landless, who was himself, I think, to have perished in assisting Tartar finally to unmask and seize the murderer."

This in the main agrees with my article in the *Cornhill*, which was *solely* based on internal evidence.

Forster adds that Dickens had a "fear that he might have plunged too soon into the incidents leading on to the catastrophe, such as the Datchery assumption in the fifth number (a misgiving he had certainly expressed to his sister-in-law)." Forster mentions this without giving the

* *Fortnightly Review*, Sept., 1878, p. 386.

slightest hint of Dickens having remodelled his idea since explaining it *in confidence* to himself. Had Datchery been Edwin Drood in disguise, would not Forster (speaking as he does here) have told how it was that Dickens had altered his original design?

Which idea would an unprejudiced reader think the more worthy of belief—that put forward by Mr. Foster, or that supported by the testimony of Dickens's dearest friend, and by Mr. Fildes, the illustrator of "Edwin Drood," to say nothing of the evidence contained in the tale itself?

However, it is only fair to examine some of Mr. Foster's arguments, since it is impossible to examine all in the course of a necessarily short letter. He quotes the heading of a chapter, viz., "When will these three meet again?" and adds, "showing clearly that Neville, Drood, and Jasper were to meet again." Where did Mr. Foster learn logic?

He insists that the tone taken by Grewgious towards Jasper, at their meeting after Edwin's disappearance, admits of but one interpretation, which of course is his own. But what was there to prevent Grewgious being present when Neville was first brought back to Cloisterham? If he did so see him, he might draw his own conclusions from Neville's demeanour whether he was innocent or not. And if he concluded Neville to be innocent, on whom should his suspicion fall but on Jasper, whose affection for his nephew is certainly overdone? The very fact that Grewgious did *not* call on Jasper directly, and that, when he *did* call, his behaviour was almost brutal, admit of the interpretation that in the interval he had learnt all that Rosa and Neville could tell him, and had formed an opinion which he kept to himself for the present.

Mr. Foster has evidently a great belief in human credibility. He asks us to believe that Edwin is first of all drugged by Jasper (an expert in the art); then half-strangled by the thick black scarf; then thrown from the top of the tower (albeit something conveniently breaks his fall on the way); then placed in quicklime; and finally locked up in the tomb in which the lime has been arranged. Yet in spite of all this he asks us to believe that Edwin (still half-strangled by the scarf) is able to shout loudly enough to be heard and rescued by the drunken Durdles!

Is all this meant seriously, or is Mr. Foster laughing at us? Why, cats with their nine lives are nothing to *his* Edwin's one!

Again, what would Jasper's motive be in throwing Edwin from the top of the great tower? Mark the *great!* A body falling from such a height would to a certainty be more or less mangled, and blood might be expected to remain upon the ground, if nowhere else; while Jasper in the darkness would have no means of effacing any such fatal traces. Supposing Mr. Foster's theory to be correct, is it credible that a man like Jasper should run the risk of leaving such tell-tale witnesses upon the scene? Why not strangle Edwin near the tomb, especially as he may be supposed to have been drugged to make him less capable of offering resistance?

"We may suppose that Durdles dragged the body out of the tomb and out of the crypt." So says Mr. Foster, who has here convicted himself. He has before said that Edwin's body was placed by Jasper in Mrs. Sapsea's tomb. Now, had he read the book as one would expect such an appreciator of Dickens's prose poetry to read it, he would have noticed that Mrs. Sapsea's tomb was *not* in the crypt, but in the churchyard; as is shown in two different passages of the book. This error has, of course, led Mr. Foster into others, especially in the concluding papers.

Full half a year after Edwin's disappearance, Datchery is introduced, and Mr. Foster invites—nay, bullies us to believe, that Datchery is Edwin disguised. Disguised! but is it possible that in less than a year Edwin could have changed so much that Jasper, the Topes, *and others* should fail to recognise him? To completely disguise face, and eyes, and voice, after so short an interval, would not be easy; and Datchery speaks in Jasper's presence.

When Datchery meets with the opium woman, and "reddens" as he stoops to pick up the money he has purposely dropped, he reddens when she mentions the name Edwin. From this, Mr. Foster deduces that Datchery and Edwin are one and the same person. But were it so, the woman's former words (before this mention of Edwin's name) alone would have enabled him to identify her with the woman he had befriended on that Christmas Eve; and therefore Datchery's reddening *with surprise* at the name Edwin seems to me to be the result of his suddenly obtaining a clue to the mystery. The scene, to my mind, helps to prove that Datchery is *not* Edwin.

There are two or three questions that may fairly be asked of Mr. Foster, viz.:—

Would Durdles be able to keep so momentous a secret as that of having rescued a man who was locked in a tomb and nearly covered with quicklime? He could scarcely have been so drunk as to *forget*, for he was sober enough to effect the rescue; and drunken men are scarcely the ones to keep secrets. Would Deputy hold his tongue—especially if a reward for information were offered?

How high is "the great tower"?

And, hardest question of all to answer satisfactorily—How could Edwin in common fairness (if alive) have permitted Neville Landless to bear for six months and more the terrible suspicion of being his murderer? Also, would not the reappearance of Edwin be somewhat of an anti-climax, a mistake just as the bringing to life again of Athelstane in "Ivanhoe" is felt to be a mistake?

Mr. Foster's conclusion does not add much to be commented on. Grewgious's conduct about the missing ring admits of another interpretation to that there put on it. Knowing that Edwin had the ring, he waits to see if by it Edwin's body may yet be found and identified. Jasper, he argued apparently, did not know of the ring; and to find the ring is to solve the mystery; therefore, he is for awhile silent about it. In Mr. Foster's account of Jasper's re-opening the tomb, he again places it in the crypt, which I have pointed out to be wrong; hence the idea of the flight up the staircase is at any rate incorrectly introduced.

The illustrations are certainly important evidence; but I fail to see that the figure in the tomb *must* be Edwin. The retribution would be terrible enough were it Neville or anyone else, for Jasper, in horrified surprise, could but conclude it to be his victim brought to life to condemn him.

Mr. Foster might write column on column to support his theory; but when coolly and impartially viewed, I cannot see how it can be pronounced to be more than a highly ingenious but highly unsatisfactory attempt to graft upon the facts as told by Dickens a conclusion as imagined by himself.

H. L.

OPTICAL RECREATIONS.

By A Fellow of the Royal Astronomical Society.

(*Continued from p.* 280.)

WE concluded our last article on pp. 278 *et seq.* with some account of the optical effects produced by the persistence of vision for a very short time after the image of the object viewed actually ceases to fall on the retina. We propose to-day to describe a very interesting

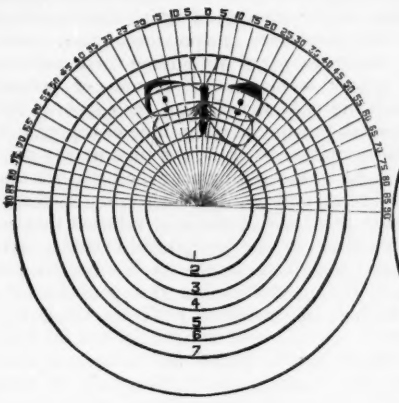


Fig. 31.

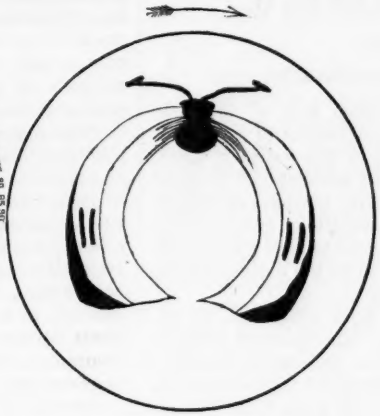


Fig. 32.

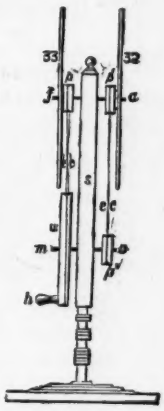


Fig. 34.

illusion referable to some extent to this property of retention which the eye possesses, and to instruct the student how to construct the necessary apparatus for exhibiting it. The toy—if it be a toy, and not rather a refined philosophical instrument—was brought out a good many years ago, under the name of the Anorthoscope, from two Greek words signifying to set the vision right. That it is very appropriately named the reader will immediately see. It seems hard to understand why it has so utterly fallen into oblivion. As our object here is rather to provide the student with striking and amusing illustrative experiments than to enter into expositions of recondite optical laws, we will proceed to our description at once. If, then, a figure, distorted according to principles immediately to be explained, is delineated on a disc, and this disc turned round, while a black disc with four radial slots is caused to rotate four times as fast, and in an opposite direction in front of it, the spectator will see five stationary images of this distorted figure, but restored to its natural proportions!

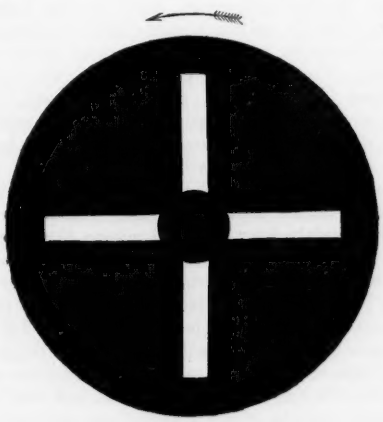


Fig. 33.

First, then, to draw the figure, which we will suppose, for the sake of illustration, to be a butterfly. We begin by striking two circles (Figs. 31 and 32), dividing them by radial lines at any convenient distance. In Fig. 31, such division is made at every 5°. Only half the circle, or 180°, is so divided in our figure; but Fig. 32 was similarly divided right round the circle for a reason which will be immediately obvious. We also strike a series of circles interior to our larger one to fix certain points in our drawing. Very well; in our first divided circle (Fig. 31) we now proceed to draw the best butterfly we can, and, having finished it, note with the greatest care where the different points of the figure fall. In copying it, we must be careful to preserve the radial length or central distance of each part with the utmost accuracy, *but we must expand it laterally to five times its original angular dimensions.* For example, the tips of the butterfly's antennæ are each in circle 7, and the lines marking 5° on each side of the median one. Hence, we must put the same tips in Fig. 32, still in circle 7, but on the lines marking 25° (*i.e.*, $5 \times 5°$). The upper corners of the wings fall on circle 6, and on the lines marking 25°. The corresponding points in Fig. 32 are, of course, as before, on circle 6, but on the 125° (or $5 \times 25°$) lines; and so with the markings and other leading features.

It now only remains to join the points thus obtained, rub out our division lines, and we have Fig. 32. Fig. 33 shows the disc of black cardboard with four radial slots, which is to rotate before the diagram which we have just produced, and Fig. 34 represents in section the apparatus by the aid of which the necessary motion is given to them both. Here S is a stout, square, wooden stem on a stand, through which pass two axes—*f*, *a*, a fixed axis, and *m*, *a*, an axis moving with the wheel upon it. On the fixed axis rotate two pulleys (or grooved wheels) $p\,p'$, obviously independently of each other. A third pulley p'' is immovably attached to the axis m, a, so as to turn with it. These three pulleys are all of precisely the same diameter. The wheel *w*, also fixed to the axis *m a*, is four times the diameter of p, p', p''. Hence it will be seen that if endless cords $e\,e$, e', c', go round p', p'' and w, p respectively, p will rotate four times as fast as p'. It will be noted that the cord $e'\,c'$ is crossed in order that p may turn in an opposite direction to p' also. Finally we attach our black disc with the radial slots, 33, to p and our distorted figure (32) to p', light the latter well, turn the handle *h*, and look through the slots. The spectator who sees the five stationary butterflies for the first time, will, we venture to think, hardly do so without an exclamation of astonishment. Of course, any figure whatever may be distorted on the same principle.

It is stated that the entire number of the cases of cholera, and of the deaths from it, at Naples has now been computed. In the city of Naples there were 12,402 cases and 6,629 deaths. In the whole of the province of Naples there were 14,037 cases, and 7,576 deaths.

ELECTRO-PLATING.

By W. Slingo.

XIV.—PREPARING THE OBJECTS.

IN the practice of electro-plating, one of the first necessities is to ensure that the surface of the object to be plated is clean, and this not in the ordinary acceptation of the term, but as a chemist understands it—that is to say, the surface must be free from particles of foreign matter of all kinds. The smallest particle of grease or dirt adhering to the object is quite sufficient to spoil the deposit, for wherever that particle happens to be the deposit will be little or nothing.

There is, perhaps, no species of work which calls so imperatively for absolute cleanliness. The touch of a finger, unless the skin be covered with some preventible material, is sure to leave a very distinct impression; and, even when the surface of the object is chemically pure, there is some danger of the deposit only partially adhering in consequence of the intervention of a film of air between the object and the solution. The film of air which associates itself, more or less, with every object exposed to it, must, therefore, be carefully and completely removed; but of this a word will have to be said presently. Then, again, there are some metals which are so easily oxidised that a brief exposure to the air of the clean surface is sufficient to cause it to be coated with a thin film of oxide, and oxides are more or less non-conductors of electricity.

The metals which are most likely to be called into requisition for planting purposes are iron, lead, tin, copper, brass, Britannia metal, and German silver.

Iron is a metal which has generally a somewhat extensive supply of superficial impurities, to remove which it may be placed in a weak acid solution consisting of 1 oz. of hydrochloric acid, and 4 oz. of sulphuric acid to the gallon of water. After remaining in this solution for some little time it may be removed and the surface rubbed with a wet brush and a little sand. If this fails to cleanse the surface, the iron must be re-immersed, and the rubbing operation repeated until a clean metallic surface is produced.

Sometimes emery-cloth will be sufficient to remove the dirt; but the wet process is, perhaps, preferable, and has the advantage of leaving a smoother surface, unless, indeed, the degree of rust or oxidation is very variable—deep in some places and very thin in others—when special means must be resorted to in order to procure a level surface. It must be borne in mind that the ultimate coating will present a surface the very counterpart of that upon which it is deposited, and that, therefore, it is necessary that the surface of the object should be freed from all "foreign" or undesirable irregularities, including file-marks, hammer-marks, &c. The acid solution is very efficacious for the removal of oxides of the metals, but must not be relied upon for the removal of grease-spots, unless they are very small, and likely to be so far under-eaten as to ensure their being removed by the sand and brush. When a quantity of grease is present, it may be removed by immersing the object in a solution of caustic soda, which will effectually dissolve away the troublesome fats. This should be done prior to immersing the iron in the acid solution. The object having been subjected to these cleansing processes, is then well washed with clean water, and immersed in the electrolytic bath.

It is to be noticed, however, that a silver coating deposited direct upon iron is generally very unsatisfactory, and likely to strip off. To prevent this, a thin layer of copper is interposed. As, however, iron would be dissolved in a sulphate of copper solution, the copper is best deposited in a cyanide of copper solution of which there are several, one of them being mentioned in a previous article. Another one is very easily prepared by adding to a solution of sulphate of copper a solution of cyanide of potassium, adding it gradually until the whole of the copper is thrown down as a greenish precipitate of cyanide of copper. After allowing this precipitate to settle, the supernatant sulphate of potassium solution is carefully poured off, and the cyanide of copper washed several times with clean water, thus effectually removing any trace of the acid solution that might otherwise have clung to the precipitated cyanide, and subsequently caused some little trouble by dissolving a portion of the iron. The precipitate has then poured over it a solution of cyanide of potassium, until the whole of it is again dissolved. In this, as it is not a solvent for iron, the ferruginous object may be placed and connected with the negative pole of a battery, the positive pole of which is connected with a sheet of copper placed in the same bath as the iron. In a short time a sufficiently thick coating of copper will be deposited, when the object may be removed, and, after being well rinsed, placed in the silver-plating bath.

Zinc may be treated in a similar way, except that the hydrocholoric acid may be omitted from the acid solution, or the action will probably be too energetic for the purpose.

Tin, lead, and Britannia metal should not be placed in the acid solution, but should be immersed in the caustic-soda solution, by which process oxides of the metals, as well as superficial grease spots, &c., are removed.

On being withdrawn from the caustic-soda solution, such articles should be transferred to the depositing-bath without being subjected to the washing process. When very dirty, it is advisable to rub them first with silver-sand and water, applied with a tolerably stiff brush. The deposition of a preliminary or intermediate coating of copper is almost as advantageous in the case of lead or tin objects as it is in the case of iron. When this method is adopted, it is necessary to prepare the surface of the copper-film by slightly burnishing it, and then well rinsing it in clean water. A high degree of finish to the burnishing is, however, rather advantageous than otherwise, as it is likely to render the deposit of silver more or less non-adherent. The necessary condition of the surface is best produced by means of a "scratch-brush," which consists of a number of bundles of fine brass wire fixed round the edge of a flat wooden disc. This brush is placed as a chuck on a lathe and made to revolve rapidly, the metal to be brushed being pressed against the wires, while a small barrel or other vessel containing a quantity of stale beer is fixed above the brush and provided with a tap through which the beer is allowed to run on to the object. It is not, however, necessary that a lathe should be called into requisition for this purpose There are any number of simple devices possible for attaining the object quite as efficiently as could be done with a lathe. Perhaps the simplest method is to attach a small pulley-wheel to the side of the scratch-brush, and then, mounting them on a smooth metal spindle, connect the pulley wheel by means of a gut or other band with a considerably larger wheel, similarly mounted, at a short distance from, but in the same plane as the smaller wheel. Very good results may be obtained with apparatus of this kind. The scratch-brush is a tool which is best purchased, and which is not very expensive.

German silver, if dirty or greasy, is first washed in a solution of caustic soda, and then well rinsed. After this it is treated with powdered bath-brick applied with a hard

brush, the fingers holding the object being well provided with a quantity of the powder to prevent their impression being left on the article to the detriment of the silver surface to be presently provided. When the surface is extensive, it is very desirable that, in applying the bath-brick, it should be worked as evenly as possible. It is a good practice to finish cleansing by rubbing the surface with a piece of damp chamois leather, provided with some finely-powdered bath-brick, the fingers being moved in circles. In this way a tolerably smooth surface may be imparted. When the bath-brick process is finished, the object is thoroughly washed with clean water. Superficial impurities may be removed by brief immersion in a solution composed of equal quantities of sulphuric acid and water, with a little nitric acid added. Verdigris is removed by the application of a little hydrochloric acid.

AMERICAN FOREST FIRES.

THIS is the season for forest fires, and in many parts of the country we hear of great destruction already from burnt fields and forests. The New Bedford *Evening Standard*, in an article on the subject, says:—Few people realise how serious a calamity these fires have become. Already in the most thickly-settled parts of the country good working wood is becoming scarce and high, although there is often a glut of inferior grades, and therefore very low prices for them. The correspondents of the lumber journals report from almost all quarters that the demand for really good material is generally in excess of the supply. The only hope for the future lies in economy of what we have, and in whatever will encourage those owning young timber to keep it and prune it, and thin it out so as to bring it on to fill up the gap. But forest fires destroy an amazing amount of the precious mature stock—how much no one knows—but it is said by experts that the amount destroyed probably equals the amount cut. Now, we know that the sawed stuff (to say nothing of fuel and charcoal, ties, telegraph, and hop poles, &c.) reaches an annual value of over 230,000,000 dols. at the mills, so that, counting other forest products besides sawed stuff thus destroyed, it is, no doubt, within reason to say this waste, largely needless, is not less than 300,000,000 dols. a year. But this is not all, and very likely it is not the worst. Such fires burn up a great amount of young growth and of seed, and in some cases even the soil itself is roasted to death, so that for a long time afterward it will not bear anything of value.

Mr. Swan states that he has obtained 5,800 hours as the life of an incandescent lamp, and large numbers of the Swan lamps are said to have reached 4,000 hours.

We hear that a Working Man's Club and Institute is to be established in connection with the Royal Victoria Coffee Hall. It will be supported by the subscriptions of the members (minimum 1s. per quarter), and the donations of those who are interested in the movement. Mr. Robert W. Bowers, of 89, Blackfriars-road, will furnish any information needed by those who may wish to co-operate in so praiseworthy an object.

A Church Built from a Single Tree.—A redwood tree, cut in this county, furnishes all the timber for the Baptist church in Santa Rosa, one of the largest church edifices in the country. The interior of the building is finished in wood, there being no plastered wall. Sixty thousand shingles were made from the tree after enough was taken for the church. Another redwood tree, cut near Murphy's Mill, in this county, about ten years ago, furnished shingles that required the constant labour of two industrious men for two years before the tree was used up. The above statements are vouched for as true by Supervisor T. J. Proctor.—*Santa Rosa (Cal.) Republican.*

A TOTAL LUNAR ECLIPSE.

By Richard A. Proctor.

THE recent total eclipse of the moon presented phenomena of considerable interest; and as usual with lunar eclipses was made the subject of comments indicating considerable misapprehension of the real circumstances of such eclipses. So much more interest attaches to total solar eclipses, that most of their phenomena are pretty fairly understood; but with lunar eclipses the case is different. Thus in the case of the recent eclipse, even the account given in the *Times* of Oct. 6, though obviously written by official astronomers at Greenwich, contained errors in regard to the physical phenomena of the eclipse. It assigned as a reason for the darkness of the moon during totality the (presumed) freedom of the earth's atmosphere from vapour, which would indeed have explained the absence of ruddiness, but would have left the darkness of the moon during totality a greater mystery than ever. It also repeated the well-worn mistake of assigning diversities of illumination of the moon's disc to the passage of the sun's rays "through parts of our atmosphere of different degrees of saturation." Irregular diversities of illumination, such as are actually observed during total lunar eclipses, cannot possibly be explained in this way.

I propose to take this opportunity to discuss the circumstances of a lunar eclipse in a new way, which possesses the advantage of being simpler than the customary plan, and is also more instructive in regard to the physical problems involved. I take the eclipse of Oct. 4th, but any other total lunar eclipse would have served my purpose equally well.

Every student of astronomy knows the usual way of dealing with lunar eclipses, in which the passage of the moon through the earth's shadow is considered*, and the station of the observer is supposed to be on the earth, the general elements of the eclipse being taken for the earth's centre. Let us, instead, set our observer on the moon, or for convenience at the moon's centre, and consider the way in which the earth's disc would seem to pass athwart the face of the sun.

The elements of the eclipse, as given in the *Nautical Almanac*, are obviously translatable at once into the following (only differing in taking the motion of the earth's centre, as seen from the moon's, as the exact opposite of the motion of the moon's centre seen from the earth's):—

	h.	m.	s.
Greenwich Mean Time of Conjunction in R.A., Oct. 4	10	8	5·1
Right Ascension of Earth and Sun	12	44	25·02
	°	′	″
Earth's Declination	S 4	57	57·9
Sun's Declination	S 4	46	33·6
Earth's Daily Motion in R.A.		34	13·5
Sun's Hourly Motion in R.A.		2	16·7
Earth's Hourly Motion in Declination	S	10	52·9
Sun's Hourly Motion in Declination	S		57·7
Earth's Equatorial Semi-diameter		59	23·0
Sun's True Semi-diameter (seen from Moon)		15	59·9

The only element here altered is the sun's semi-diameter, which in the *Nautical Almanac* is given as 16′ 2″·4″: this of course has to be reduced as seen from the moon; and to reduce it, we have to use the only element omitted above, viz., the solar parallax, or 8″·9; for the moon's parallax 59′ 23″·0 divided by the sun's gives the sun's distance as compared with the moon's, or almost exactly as 400 to 1;

* This seems the most natural and obvious way of dealing with the problem; but it gives no information as to the cause of diversities of illumination depending on the condition of various parts of that zone of the earth's atmosphere through which the sun's rays are refracted towards the moon.

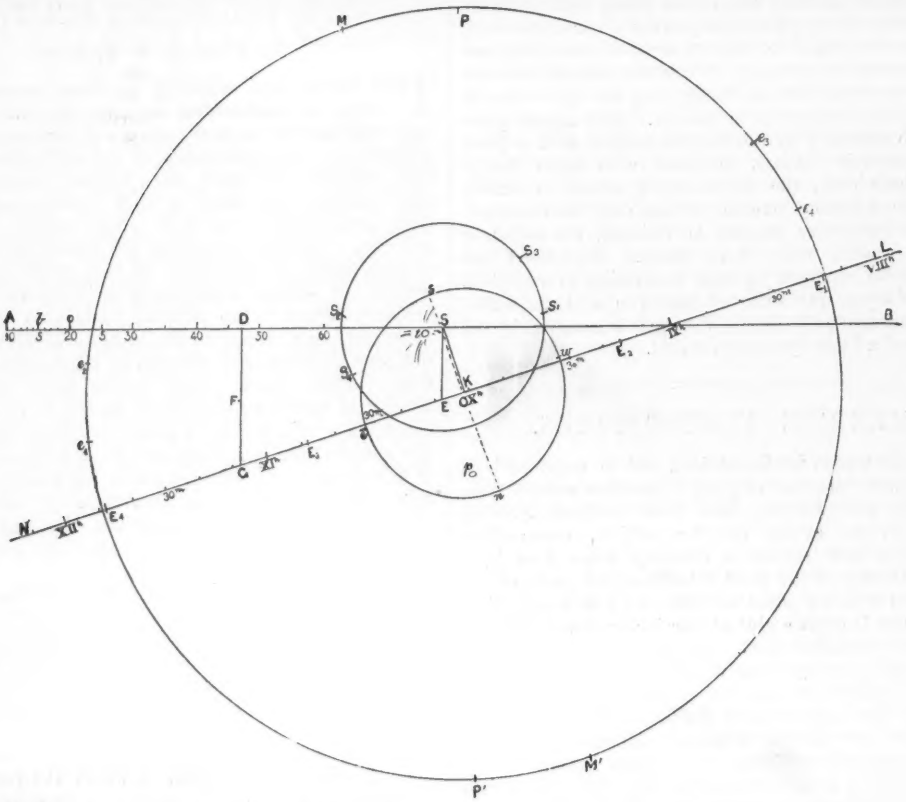


Fig. 1.—Illustrating the Geometrical Investigation of a Lunar Eclipse.

and we must subtract a 400th part from the sun's semi-diameter as seen from the earth to get that semi-diameter as seen from the moon.

With these elements our work is easy:—

We note first that at 10 h. 8 m. 5s.·1, Greenwich mean time, the earth's centre is 11′ 24″·3 (the difference between the declinations given above) south of the sun's centre. Draw then a straight line A S B, Fig. 1, to represent a parallel of declination through S the sun's centre, and with any convenient length A *b* to represent 5′, take S E square to A B to represent 11′ 24″·3: then E of course represents the earth's centre at the time of conjunction of earth and sun, in R.A. Now it will be obviously convenient to keep the sun's centre at S throughout our investigation; so instead of having both the sun and earth moving, we note that the earth gains on the sun, hourly, in R.A. 31′ 56″·2, and in declination 9′ 55″·2 (we get these by taking the difference between the hourly motions of the sun and earth tabulated above). Now if A S B represented a declination-parallel farther from the equator we ought to note that a degree in R A along A B is less than a degree along the equator; but as a matter of fact the difference is not more than 1-250th part, and need not here trouble us. So, first making a little scale of arc-minutes along A B, we set off along S A a distance S D to represent 31′ 56″·2, and along D F square to S A take D F=11′ 24″·3, and F G= 9′ 55″·2; or D G = 21′ 19″·5: then E G represents the earth's motion from the sun during the hour following conjunction in R.A. We draw L E G N to represent the track of the earth's centre; and S C square to L N, gives the position of the earth's centre C at the time of nearest approach to the sun's, or the time of mid totality. E C will be found to be about a tenth of E G the hourly motion; that is, E C corresponds to about 6 min., and central eclipse occurs therefore 6 min. before conjunction in R.A.

It will be convenient to take K a point one-third of E C to the right of C, corresponding to the position of the earth's centre at 10h., and then to mark in, carefully, the hour and minute divisions corresponding to the earth's motion already determined.*

Now describe round S a circle with radius 15′ 59″·9 (16 will do well enough) to represent the sun's disc; and round C a circle with radius 59′ 23″ to represent the earth's; thus we have the relative position of the sun and earth, and their relative dimensions, at the time of central totality,—the observer being supposed to be at the moon's centre.

We see that were it not for the refractive action of the earth's atmosphere the sun ought to be entirely hidden at this time. This action brings the sun into view all round (since C, the earth's centre, falls within the circle corresponding to the sun's disc). But we note that more light will be brought round the northern side of the earth than

* Also, we have,—

$$S C : S E :: S D : G E$$

$$\text{or } S C : 11\tfrac{1}{3} :: 32 : \sqrt{(32)^2+(10)^2}, \text{ nearly enough}$$

(we have given approximate values to S E, S D, and F G). Or

$$S C = 11\tfrac{1}{3} \times 32 + 33\tfrac{1}{3} \text{ approximately,}$$

$$= \frac{34}{3} \times 32 \times \frac{5}{168}$$

$$= \frac{34 \times 20}{63} = 10\tfrac{4}{9}' \text{ very nearly.}$$

round the southern, the actual maximum (apart from cloudiness of the air) being at the point marked M, on C S produced. The north pole of the earth is at P, supposed to be on the face of the earth turned moonwards at this moment. This face is shown in Fig 2.

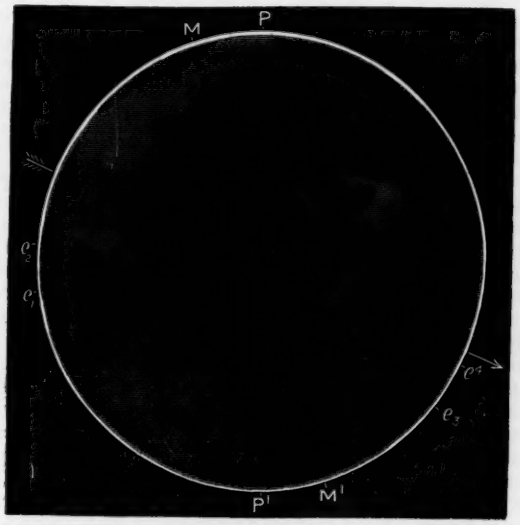


Fig. 2.—Earth's Face turned Moonwards at the time of Central Eclipse.

Fig. 1 shows how the earth's centre, C, is situated with respect to the centre of the sun, S. Both figures are for the centre of the moon's earthward face. For other parts of that face we should of course get different relations. An observer on the moon travelling northwards or southwards from the centre of the moon's earthward face* would shift the earth's centre southwards or northwards as from C towards s or n respectively; and it is easily seen he could raise it no farther than s or n, where C s or C n represents the semi-diameter of the moon's disc in the above table, reduced by one-400th part (because as the earth's centre is shifted the sun's centre is shifted by about one-400th part as much, his distance exceeding the earth's distance 400 times). Travelling eastwards or westwards from the centre of the moon's earthward face, the earth's centre would be thrown eastwards or westwards,† by distances which cannot exceed 16′ 10″ represented by C w and C e. Thus we can describe the circle $s\,e\,n\,w$ with radius 16′ 10″ to show the area within which the centre of the earth's disc would lie at the time of central eclipse as seen from different parts of the moon's earthward face. It will be seen that the eclipse was absolutely central for a point on the moon corresponding to the position of S on the disc $s\,e\,n\,w$. This was not far from the place of Tycho, shown at t. A lunar observer on Plato would have had the centre of the earth situate nearly as at p—outside the disc $S_1S_2S_4$—and therefore would have had an arc of sunlight round a part only of the earth's disc. In any other place on the moon we have only to set the place in its proper quadrant of the moon, as indicated by the letters s, e, n, w. We might make a map of the moon within the circle $s\,e\,n\,w$ (as suggested by the rays from Tycho), the only difference from an ordinary map of the moon being that our map would interchange east and west, or appear as the usual map does when held opposite a looking-glass.

In Fig. 1, E_1 and E_4 are the positions of the earth's centre at the time of first and last contact with the total shadow, and are obtained by describing an arc round S as centre with radius C M − C s + C S to cut L N in E_1 and E_4; E_2 and E_3 are the positions of the earth's centre when total eclipse was just beginning and just ending, and are obtained by describing an arc round S as centre with radius equal to C M − C s − C S, to cut L N in E_2 and E_3. S_1, S_2, S_3, and S_4, are the points where E_1, S_1, E_2, S (produced), E_3 S (produced) and E_4 S meet the edge of the sun's disc. Lines from C parallel to these four lines meet the circle representing the earth's disc in the points e_1, e_2, e_3, and e_4, corresponding to those parts of the edge of the disc which give the part of the umbra (i) first seen on the moon's face, (ı) just completing totality by coming up to the moon's edge; (iii) just ending totality by leaving the moon's edge, and (iv) last seen on the moon's face.* The corresponding points are marked on Fig. 2, and also on Fig. 3, which represent the "sun-view of the earth" for the time of central eclipse. Only, of course, it will be noticed that as both these maps are for 10 h. 2 m. Greenwich mean time (p.m.), the aspect for the four epochs just dealt with will be considerably different. The times for these are respectively:—

(i) 8 h. 15·2 m.
(ii) 9 h. 15·8 m.
(iii) 11 h. 48·8 m.
and (iv) 12 h. 47·2 m.
} Greenwich mean time (p.m.),

and about 11½ m. later for Greenwich solar time. It will be easy for the student to make corresponding projections

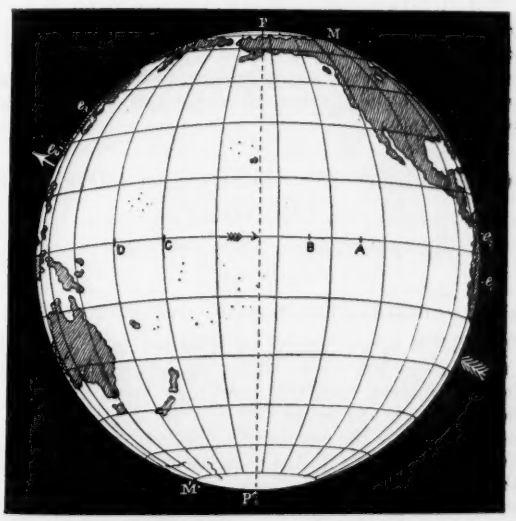


Fig. 3.—Sun view of the Earth at the time of central Eclipse. Oct. 4, 10.2 p.m. (G.M.T.)

from Fig. 3, in which the longitude and latitude lines have been left in for his guidance. For (i) the point A in Fig. 3 must be brought on the central meridian PP′; for (ii) the point B; for (iii) the point C; and for (iv) the point D. Corresponding changes may be made in Fig. 2; but, as a matter of fact, there is no occasion to use both projections.

* Not the same as northwards or southwards relatively to the celestial equator,—but nearly northwards or southwards relatively to the ecliptic.

† Not westwards for an easterly movement, and *vice versâ*, because as we face the full moon the eastward side is on the left, whereas as an observer on the moon faces the earth the eastward side of her disc is towards the right.

* These radii, C M − C s ± C S are deduced from the consideration that the earth's disc (radius C M) is just to touch the sun's disc (radius C S) (i) externally (ii) internally, as seen from only one point on the moon's surface, that point being on the edge of the moon's disc (radius C s).

It will be seen that when M. Ad. de Boë, of Antwerp, noticed the remarkable appearance pictured at p. 325, the Cordilleras were not at the edge of the earth's disc near e_1, as my friend, Captain Noble, suggested. Probably the projection at *a* in M. de Boë's figure corresponded with cloud-layers above the western parts of the North Atlantic, near the shores of French Guiana, and northern Brazil (north of the mouth of the Amazon), or it may have been an effect of irradiation only.

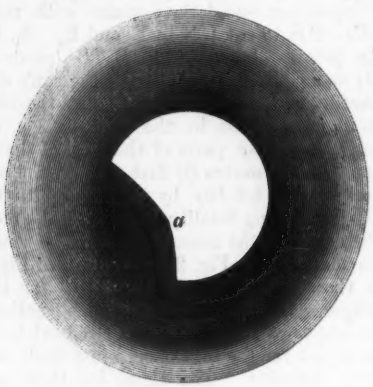


Fig. 4.—The Lunar Eclipse of Oct. 4.

Many pretty problems will suggest themselves to the student in connection with the outline of the subject here presented. But the majority of our readers will probably consider that space ought not further to be given to a subject belonging wholly to the geometry of astronomy.

I shall take occasion shortly, however, to touch on the way in which the sun, when geometrically behind the disc of the earth as seen from the moon, is brought into view by refraction,—a matter about which much misapprehension exists, even among professional (by which I mean official) astronomers.

CHAPTERS ON MODERN DOMESTIC ECONOMY.

IV.—THE FRAMEWORK OF THE DWELLING-HOUSE (*continued*).

GENERAL PRINCIPLES OF CONSTRUCTION.

TOBIN'S tubes, which we were led to mention incidentally last week, whilst discussing the subject of inlet ventilators, consist of wooden or metal tubes, a few inches square and about five feet in length. They are usually fixed in the corners of rooms, are open at the top, and communicate with the outer atmosphere at the bottom, through air-bricks or gratings. It is sometimes advisable to have the external portions of these pipes bent vertically downwards, outside of the walls to which they are affixed —a method which diminishes the quantity of air-borne dirt which is liable at all times to enter the apartment in spite of every care. The tubes need not interfere with the artistic arrangements of the room. Indeed, they may be made to add to its general beauty—*e.g.*, in the drawing and dining rooms they may be introduced beneath bottomless vases of Doulton ware, or in many other ways to harmonise with the internal decorations.

A decided improvement upon these simple vertical tubes is that known by the name of "Ellison's Expanding Ventilating Tubes." The principle of the "conical ventilator," noticed in our last communication, is here added to the vertical tube in its expanding upper free extremity. This has the effect of spreading the air over a large area, and thus preventing draughtiness. These ventilators ought to be inserted through the wall at the height—from 6 ft. to 8 ft. above the floor—at which they are to be fixed; it is not necessary, as in the long "Tobin's tubes," to carry them upwards from the level of the floor. Mr. Ellison, the inventor, recommends that they should be placed above the spaces allocated to seats, or similar low pieces of furniture. They are made of zinc, either with or without closing and opening valves, and are to be recommended on account of their cheapness, durability, and effective action.

We have considered how fresh air ought to be conveyed into the apartments of a house by simple passive means, and it now remains to provide for the removal of the vitiated air in the establishment of a rational system of house-ventilation. A suitable outlet ought to be made beneath the cornice, or at the highest available part, a few inches below the ceiling in the smoke-flue, and a mica ventilator, or other valvate arrangement, fixed therein in such a way as to prevent the regurgitation of smoke and its unpleasant passage into the house. Smoky and sluggish chimneys, however, are very apt to give great trouble with such an apparatus, which is best adapted to work in conjunction with chimneys which have a good upward daught, and are not exposed to the influence of the prevailing winds through the use of well-devised cowls and protectors. It is a very difficult matter to fix an outlet ventilator which shall work with any degree of success in opposition to the chimney in an opening made through an external wall, otherwise the aërial circulation would be considerably simplified.

The removal of heated air and the products of combustion from gas and other analogous illuminators can be effected by the simple expedient of inverted tubes with expanded mouths placed directly over the flames, and constructed in such a way as to lend a pleasing and artistic aspect to the room. We shall give a few special illustrations of this when we come to treat of the question of domestic lighting.

It is a very common error to suppose that lofty ceilings are conducive to good ventilation in proportion to their greater height. Such is not the case; the contaminated air, in consequence of its relatively high temperature, ascends; it goes on parting with its heat, and, if the ceiling is very high, it descends with redoubled speed in virtue of its greater specific gravity, instead of escaping through the outlet ventilator, whilst its warmth is still sufficient to cause it to ascend through the aperture in the chimney flue. In a moderately low-ceilinged room the foul air escapes readily, and the purity of the atmosphere is thus secured. Hence it is advisable, volume for volume, to have breadth and width rather than height.

The fireplaces in a house exercise an important influence over its ventilation. As the kitchen fire is the one which is most constantly employed, it often happens that its action induces a down-current in the other rooms, which may reach from the highest floor even to the very basement. It is, therefore, important to isolate the several apartments and passages of a house as much as possible, in the event of communicable disease from one room to another through these general draughts.

We have laid great stress upon the ventilation of inhabited apartments, because it is a subject which seems to be almost universally neglected in practice. We have endeavoured to show how all the benefits of a pure atmosphere indoors can be easily gained, through the use of simple and inexpensive apparatus, and we are confident

that if our readers adopt the measures we have indicated, they will be amply repaid by the enjoyment of increased bodily health, and freedom from the many ills which are attendant on a defective system of ventilation or an entire absence thereof.

We presume that the majority of minor dwelling-houses are devoid of any well-regulated system of ventilation; the holders of such abodes would do well to test the atmosphere of their apartments, and improve their condition if necessary. As the percentage of carbonic acid gas usually indicates the state of atmospheric impurity, it is of advantage to ascertain its relative quantity by some simple expedient, such as the following tentative test:—

Conjecture the percentage of carbonic acid in the air to be tested. Then take half an ounce of perfectly clear lime-water, and agitate it, with the contained air, in a bottle holding the number of ounces standing in the following Table opposite to the supposed percentage. If a white turbidity is produced, the air contains more than the attributed quantity of carbonic acid, and the experiment may be repeated for higher proportions. The first column gives the content of the bottle, in avoirdupois ounces, including the space occupied by half an ounce of lime-water; the second column gives the percentage of carbonic acid in the air.*

Av. oz.	CO_2	Av. oz.	CO_2
15·60	·04	2·51	·30
10·57	·06	2·01	·40
8·05	·08	1·71	·50
6·54	·10	1·51	·60
5·53	·12	1·36	·70
4·53	·15	1·25	·80
3·52	·20	1·17	·90
2·92	·25	1·10	1·00

On April 18, 1881, a letter appeared in the *Times*, signed "F. R. C. S.," in which the writer, whom we have reason to believe is an eminent London surgeon, detailed his experiences in converting an insanitary abode into a healthy home. After recounting the various evils to be apprehended from the incursion of dust and dirt, such as colds, headaches, &c., which are attributed not so much to

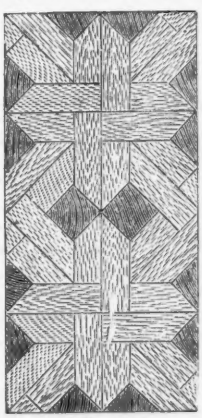


Fig. 2.

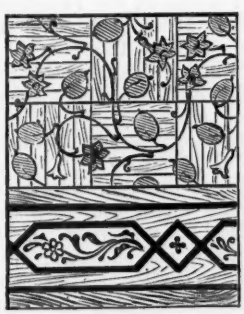


Fig. 3.

the cold temperature and chills, as to the "poisonous influence upon the mucous membrane of the respiratory passages of the septic dust which people breathe, and which, in the majority of instances, they trample out of their filthy carpets," he goes on to give an outline of the methods which he so successfully adopted. He says:—

"The first thing, of course, was to see carefully to the drainage and water arrangements, to the ventilation of soil-pipes, the condition of cisterns, and so forth. . . . . The next thing was to cover the old floors with thin oak parqueterie, both in living-rooms and in bedrooms. This was done for me by Messrs. Howard at a very moderate charge, a fact which I am the more desirous to place on record because, for one room, I employed another firm, and paid a larger sum for bad material and defective workmanship. . . . . The parquet surface was not waxed, but French polished, so that it is not slippery. It is dusted or swept every day like the top of a table, and it is washed with a sponge and spirit of turpentine when dirt is deposited upon it. The turpentine not only cleans it effectually, but also affords the benefit of its fragrant and antiseptic odour for some hours after it has been used."

Figs. 2 and 3, for which we are indebted to the kindness of Messrs. Howard & Sons, of Berner's-street, W., are examples of plain and decorative parquet floorings. Although the initial cost of this system of flooring is much over that of ordinary carpets, it must be borne in mind that they are so much more durable that, in the long run, they are in reality the least expensive of the two. The parqueterie is of two principal kinds—viz., $\frac{1}{4}$ in. and 1 in. in thickness, respectively; the former is permanently fastened to the floor of the room, whilst the latter, on a patent laminated back, admits of being taken up, in case of removal.

* This passage is quoted from the "Medical Annual" for 1883-4, p. 119, published by H. Kimpton, 82, High Holborn, London—a volume which contains an able digest of everything pertaining to health, and, as such, will be found of great value, not only to the medical practitioner, but to every intelligent reader.

OTHER WORLDS THAN OURS.

A WEEK'S CONVERSATION ON THE PLURALITY OF WORLDS.

By Mons. de Fontenelle.

WITH NOTES BY RICHARD A. PROCTOR.

THE THIRD EVENING (*Continued from p.* 378).

"LEAVING the moon on the side next the sun, we see Venus, which puts me again in mind of St. Dennis. Venus turns upon herself, and round the sun, as well as the moon; they likewise discover by their telescopes that Venus, like the moon (if I may speak after the same manner), is sometimes new, and sometimes in the wain, according to the different situations she is in with respect to the earth. The moon, to all appearance, is inhabited; why should not Venus be so, too?"

"You are so full of your why's and your wherefore's," says the Marchioness, interrupting me, "that I fancy you are sending colonies to all the planets."

"You may be certain, madam," I reply'd, "that I will; for I see no reason to the contrary. We find that all the planets are of the same nature, all obscure bodies, which receive no light but from the sun, and then send it to one another: their motions are the same, so that hitherto they are alike; and yet, if we are to believe that these vast bodies are not inhabited, I think they were made but to little purpose. Why should nature be so partial, as to except only the earth? But let who will say the contrary, I must believe the planets are peopled as well as the earth."

"I find," says the Marchioness with some concern, "a philosopher will never make a good martyr, you can so quickly shift your opinion; 'twas not many minutes since, the moon was a perfect desert; now I see you would be very angry if any one should say all the rest of the planets are not inhabited."

"Why truly, madam," said I, "there is a time for all things; and your true philosopher believes any thing, or nothing, as the maggot bites. And this is not so very improbable as you think it: for I cannot help thinking it would be very strange, that the earth should be so well peopled, and the other planets not inhabited at all; for do you believe we discover (as I may say) all the inhabitants

of the earth? There are as many kinds of invisible as visible creatures. We see from the elephant to the very ant, beyond which our sight fails us; and yet, counting from that minute creature, there are an infinity of lesser animals, which would be imperceptible without the aid of glasses. But our magnifying glasses show us, that in the least drop of rain-water, vinegar, or any other liquid, there are great numbers of little fishes or serpents, [!] which we could never have suspected there; and philosophers believe that the acid taste of these liquids proceeds from a sharpness issued through the forked stings of these animals, lodged under their tongues; and further, that by mixing certain things with any one of these liquors, and letting them stand and corrupt, will produce a new species of little animals. Several, even of the most solid bodies, are nothing but an immense swarm of imperceptible insects. Do but consider this mulberry leaf: it is a great world inhabited by multitudes of these invisible worlds. It is to them a country of a vast extent: what mountains, what abysses are there in it! The insects of one side know no more of their fellow creatures on t'other than you and I can tell what they are now doing at the Antipodes. Is it not reasonable, then, to imagine that a great planet should be inhabited? In the hardest stones, for example, in marble there are an infinity of worms which fill up the vacuums, and feed upon the substance of the stone. Fancy, then, millions of living creatures to subsist many years on a grain of sand; so that were the moon but one continued rock, I would rather she should be gnaw'd by these invisible mites than not be inhabited.

"In short, everything is animated. Imagine, then, those animals which are yet undiscovered, and add them and those which are but lately discovered to those we have always seen, you will find the earth swarms with inhabitants, and that Nature has so liberally furnished it with animals, that she is not in the least concerned for our not seeing above one half of them. Why, then, should Nature, which is fruitful to an excess here, be so very barren as to produce no living things in the rest of the planets?"

"I must own," said the Marchioness, "you have convince'd my reason; but you have confounded my fancy with such variety that I cannot imagine how Nature, which hates repetitions, should produce so many different kinds."

"There is no need of fancy," replied I. "Do but trust your eyes, and you will easily perceive how Nature diversifies in these several worlds. All human faces in general are of the same model, and yet the Europeans and the Africans have two particular molds: nay, commonly every family has a different aspect. What secret, then, has Nature to show so much variety in a single face. Our world, in respect of the universe, is but a little family, where all the faces bear some resemblance to each other; in another place is another family, whose faces have quite a different air and make. The difference, too, increases with the distance; for whosoever should see an inhabitant of the moon and an inhabitant of the earth would soon perceive they were nearer neighbours than one of the earth and one of Saturn. Here, for example, we have the use of voice; in another world they speak by signs, and at a greater distance they do not speak at all. Here our reason is formed by experience, in the next world experience contributes little towards it, and in the next to that old men know no more than children. Here we are troubled more with what is to come than with what is past; in the next world they are more troubled for what is past than for what is to come; further off they are not concern'd with either—which, by the way, I think is much the better. Here 'tis thought we want a sixth sense, which would teach us many things of which we are now ignorant. This sixth sense is apparently in another world, where they want one of the five which we enjoy. Nay, perhaps there is a much greater number of senses; but in the partition we have made of 'em with the inhabitants of the other planets there are but five fallen to our share, with which we are well contented for want of being acquainted with the rest. Our sciences have bounds which the wit of man could never pass. There is a point where they fail us on a sudden; the rest is reserved for other worlds, where somewhat which we know is unknown to them. This planet enjoys the pleasures of love, but lies desolate in several places by the fury of war; in another planet they enjoy perpetual peace, yet in the midst of that peace know nothing of love, and time lies on their hands. In a word, that which Nature practices here in little, in distributing her gifts among mankind, she does at large in other worlds, where she makes use of that admirable secret she has to diversify all things, and at the same time makes 'em equal, by compensating for the inequality.

"But is it not time, madam, to be serious? How will you dispose of all those notions?"

"Trouble not yourself," says she, "Fancy is a great traveller: I already comprehend these several worlds, and represent to myself their different characters and customs; some of them, I assure you, are *very* extraordinary. I see at this moment a thousand different figures, tho' I cannot well describe 'em."

"Oh, leave them," said I, "to your dreams: we shall know to-morrow whether they represent the matter faithfully, and what they have taught you in relation to the inhabitants of any of the planets."

(*To be continued.*)

Reviews.

SOME BOOKS ON OUR TABLE.

A Treatise on the Principles of Chemistry. By M. M. Pattison Muir, M.A., &c. (Cambridge: The University Press. 1884.)—This is a book worthy at once of its author and of the channel through which it is given to the world. As a systematic treatise on chemical philosophy, it has, probably, nothing at present to rival it in the English language. Mr. Muir sets forth the principles and laws of chemistry in a definite and perspicuous form, treating of the theories by which the relations between its facts are established, to a considerable extent from an historical point of view. He begins with an exposition of the atomic and molecular theory, and shows how it is applied to explain the phenomena of allotropy, isomerism, &c., and to chemical classification. Thermal, optical, and physical chemistry generally, make up the remainder of our author's first division of his work, to which he has applied the title, "Chemical Statics." Under the head of "Chemical Kinetics," the remaining portion of the volume is devoted to dissociation, change, and affinity, and to the relations between chemical action and the distribution of the energy of the changing system. All this is admirably done. Great pains have obviously been taken to assign to every worker his precise share in the advances effected in the science. This is as apparent in the tracing of the atomic theory through Richter, Fischer, Higgins, and Dalton, and others, down to its latest development; as in the careful balancing of the proportion of credit respectively due to those by whom the so-called "Periodic Law" has been

established. It will be gathered from this précis that Mr. Muir does not address the mere beginner. To the student, however, already possessing a certain amount of familiarity with chemical facts, his book will be found invaluable. As we close the volume, the words of the writer of Ecclesiastes, "There is no new thing under the sun," recurs to us, and we are struck by the strangeness of the reflection, that we have been perusing a masterly exposition and defence of that doctrine of atoms which, first formally enunciated by Democritus 2,300 years ago, sank for more than two chiliads into oblivion.

Among the Stars. By AGNES GIBERNE. (London: Seeley & Co. 1885.)—Why Miss Giberne should imagine that any sane English gentleman would christen his son "Ikon" is not very apparent, but when we ignore, or get accustomed to, the little bit of affectation which this indicates, we find that she really does contrive to convey a considerable amount of elementary astronomical knowledge in the volume before us. What "Ikon" learned from Herr Lehrer, Fraulein Stella, and Mr. Fritz, the young reader must go to the book himself to discover. We may pretty safely predict that, if it does not find him with a taste for astronomy, it will leave him with one. The title-page bears the date 1885; we trust, however, that so very appropriate a Christmas present for good little children, for whom it is proposed to provide a high and ennobling recreation, will be issued in time to be put to so legitimate a use.

Healthy Manufacture of Bread. By BENJAMIN WARD RICHARDSON, M.D. (London: Baillière, Tindall, & Cox. 1884.)—From time to time readers of the newspapers are startled with revelations as to the condition of many of the bakehouses in the metropolis and in other large cities and towns, and learn, with disgust and dismay, that they are liable to eat bread contaminated with alum, human perspiration and exhalations, sewer gas, cockroaches, and other abominations incidental to its manufacture in closely-confined and heated cellars. In the ordinary process of bread-making flour, potatoes, and yeast are mixed to form a "ferment," to which, at the end of six hours or so, a quarter of the flour ultimately to be used is added, and this (now called the "sponge") is set further to rise. When it is ready, the remaining three-quarters of the flour are added, and the whole kneaded into dough. This is cut into pieces of proper size, put into the oven, and baked. Such, in the briefest terms, is the process of bread-making carried on sometimes, but happily more rarely than formerly, in over-heated and ill-ventilated cellars, with occasional sewers running beside or even through them. In these stifling dungeons the perspiring workmen knead the dough with their hands or feet, and sleep in their clothes upon the "boards" on which the dough is weighed out. Now, the sole object of the fermenting process is to generate carbonic acid gas (the gas which makes soda-water, champagne, and bottled ale sparkle)—the object is, we say, to cause this gas to permeate the bread in bubbles, and so make it light and spongy. In Dr. Richardson's book he shows how this may be done by forcing the gas itself directly into the mixture of flour and water, as effected under Dr. Dauglish's patent: Dr. Dauglish's process not only involving this manifest improvement, but actually producing the loaf from the flour in the sack without its being touched by human hands, until it issues baked from the oven and ready for consumption. This is the well-known and popular aërated bread, and it is to an explanation of its mode of manufacture, and the advantages accruing from its use, that our author addresses himself. Every one who is concerned in procuring absolutely pure and wholesome bread—and who is not?—should read through the work whose title heads this notice from cover to cover.

The Principles of Parliamentary Representation. By CHAS. L. DODGSON, M.A. (London: Harrison & Sons. 1884.)—Now that a redistribution of seats in Parliament appears imminent, it behoves every one who has the welfare of his country at heart to endeavour to ensure that such distribution shall have the effect of affording the greatest chance possible to each individual elector of being represented in the House. That every elector should be so represented is, of course, impossible; but the *tendency* of legislation should be in the direction indicated. As a contribution towards the attainment of this desideratum we must afford unstinted praise to Mr. Dodgson's tract, which lays down, on mathematical principles, the numbers of voters to be assigned to each electoral district, and the number of members to be returned. He treats also of the mode of counting the votes, and goes into other practical details, which cannot fail to be of the highest value to all who approach the consideration of the subject from a scientific—as contradistinguished from the merely party—point of view. The party politician may look askance at equations as applied to the question of representation, but the wise man will read, mark, learn, and inwardly digest this little book, with the result of finding that its conclusions are at once sound and valuable.

Ethnology of Egyptian Sudan. By Prof. A. H. KEANE, B.A. (London: Edward Stanford. 1884.)—With the fate of that gallant hero, Gordon, trembling in the balance, to say nothing of complications in connection with the country itself, whereof no man may see the end, everything concerning the Sudan at present is a matter of great popular interest. In the work before us that well-known anthropologist and philologist, Prof. Keane, gives a descriptive account of the various tribes who inhabit the Sudan, furnishing details of what is known as to their origin, language, &c. Readers will be considerably surprised to learn what a heterogeneous population inhabits the area to the elucidation of the ethnology of which Mr. Keane's pamphlet is devoted.

Flatland: a Romance of many Dimensions. By A. SQUARE. (London: Seeley & Co. 1884.)—The *jeu d'esprit* whose title heads this notice is obviously the production of a follower of Lobatschewsky and Riemann—his end seemingly being to familiarise his readers with the idea that it may, after all, be only the *shape* of the space accessible to our observation which binds us down rigidly to the conception of its possession of three dimensions, and three only. The writer, whose universe is a plane, finds it utterly impossible to imagine the existence of thickness prior to his visit to this part of the cosmos, length and breadth being the only ones recognisable. He gets a certain amount of fun out of his description of "Flatland," in which the lower classes (and soldiers) are isosceles triangles, the middle classes squares, the upper middle with a tendency to a pentagonal, or even hexagonal, forms, and the aristocracy circles—the female sex in all classes being practically only straight lines. Nor does terrestrial sociology escape numerous sly pokes in the descriptions of political and domestic life in "Flatland." This daintily got-up work will afford any one (and, notably, the mathematician) half-an-hour's amusing reading.

How to Live on a Shilling a Week. By ONE WHO HAS TRIED IT. (London: T. & R. Maxwell, 1884.)—That men leading sedentary lives would enjoy better health if a larger proportion of their food were vegetable may readily be conceded. To insist, however, that every human being shall forthwith take to grazing, like a sheep (or Nebuchadnezzar), is the very *reductio ad absurdum*, and is simply calculated

to set people against vegetarianism, even in a modified form, altogether. The author of the work before us, however, tells us how he and a small boy lived upon two shillingsworth of vegetables for a whole week—the "vegetables," by the way, though, including two quarts of skim milk and three ounces of lard. It is needless to add that this was all washed down by the beverage of the lowest and most degraded races the world has yet seen—water. "One who has Tried it" overdoes the whole thing.

Mottoes and Motives. (London: Elliott Stock, 1884.)—"This," said the lamented Mrs. Gamp, "is my mortar, which I sticks to." Would that she were at our elbow to satisfy us as to which are the "mottoes" and which the "motives," in the wonderful farrago before us; inasmuch as we are utterly unable to do so by the limited light vouchsafed to us.

We have, too, on our table, Part VII. of Heath's *Fern Portfolio*, with its exquisite plates of the Maiden-hair, Polypody, and Bristle ferns, the venation in the latter being startlingly natural. Also the *Kansas City Review*, a very able Scientific Journal, *Bradstreet's*, *The Medical Press and Circular*, *The Tricyclist*, *The Sidereal Messenger*, *Society* (with its readable and exciting Christmas Number, and a large cartoon of celebrities), and *The American Druggist*.

THE FACE OF THE SKY.

FROM NOVEMBER 21ST TO DECEMBER 5TH.

BY F.R.A.S.

THE usual daily examination of the Sun's disc will be made for spots and faculæ. Maps XI. and XII. of "The Stars in their Seasons" may be consulted for the aspect of the night sky. Mercury is an evening star, but as badly placed for observation as he well can be. Venus is a morning star, and is still a bright object before sunrise, though now somewhat shorn of her glory. Mars is invisible. Jupiter rises about 11h. 22m. to-night, and a little after half-past 10 by the 5th prox., but, of course, he does not attain sufficient altitude to be favourably seen during the working hours of the ordinary amateur's night. On the night of the 29th an eclipse of his third satellite may possibly be seen at 11h. 46m. 28s., a similar phenomenon occurring with his second satellite on December 1st, at 12h. 44m. 8s. p.m. Satellite I. will pass off his disc at 11h. 15m. p.m. on December 4th, but he will be very low down. Saturn continues visible practically all night long. He is travelling away to the westward, to the north of ζ Tauri. He is a glorious object in the telescope. Uranus is invisible, but Neptune is above the horizon all night long, and may be found from directions previously given in these columns. The Moon enters her first quarter at 10h. 15·9m. p.m. on November 25, and is full on December 2nd, at 6h. 59·7m. in the evening. There will be high tides about this date. Four occultations of stars will occur at convenient times during the next fortnight. On the 25th, θ Aquarii, a star of the 4½ mag., will disappear at the Moon's dark limb at 5h. 39m. p.m., at an angle from her vertex of 135°, reappearing at her bright limb at 6h. 52m. p.m. at a vertical angle of 281°. On the 27th, a 6½ mag. star, B.A.C. 8311, will disappear at the dark limb at 4h. 19m. at a vertical angle of 104°, to reappear at the bright limb of the Moon at 5h. 25m. p.m., at an angle of 252° from her vertex. On the 30th, 38 Arietis, a star of the 5th mag., will disappear at the dark limb at 6h. 35m. p.m., at an angle of 40° from the vertex of the Moon. It will reappear at the bright limb at a vertical angle of 293° at 7h. 29m. p.m. Lastly, on December 3rd, B.A.C. 1930, of the 6½ mag. will disappear at the bright limb at 10h. 20m. at a vertical angle of 355°, reappearing at the dark limb at 10.51 p.m. at an angle from the vertex of the Moon of 305°. The Moon is in Sagittarius to-day and to-morrow, quitting it for Capricornus at 2 a.m. on the 23rd. At one o'clock that night she crosses into Aquarius, through which she is travelling until 9 p.m. on the 26th. She then enters Pisces, her journey through which large constellation it takes her until 10 p.m. until the 29th to accomplish. At this hour she passes into Aries. She quits Aries for Taurus at noon on Dec. 1, and that in turn for the northern part of Orion at 7 p.m. on the 3rd. It takes her until 6.30 the next morning to traverse this and emerge in Gemini. She crosses the boundary between Gemini and Cancer at 6 p.m. on Dec. 5, and we there leave her. [The above was inadvertently omitted from our last issue.]

"Let Knowledge grow from more to more."—ALFRED TENNYSON.

Only a small proportion of Letters received can possibly be inserted. Correspondents must not be offended, therefore, should their letters not appear.

All Editorial communications should be addressed to the EDITOR OF KNOWLEDGE; *all Business communications to the* PUBLISHERS, *at the Office, 74, Great Queen-street, W.C.* IF THIS IS NOT ATTENDED TO DELAYS ARISE FOR WHICH THE EDITOR IS NOT RESPONSIBLE.

All Remittances, Cheques, and Post Office Orders should be made payable to MESSRS. WYMAN & SONS.

The Editor is not responsible for the opinions of correspondents.

NO COMMUNICATIONS ARE ANSWERED BY POST, EVEN THOUGH STAMPED AND DIRECTED ENVELOPE BE ENCLOSED.

DOCTORING WINE.

[1515]—I see that Mr. Mattieu Williams, at page 331 of KNOWLEDGE, revives the old cry about the dangerous properties of the gypsum frequently used in the preparation of wine.

I think that the correctness of his chemical theory and opinion on this point is very doubtful. In the first place, sulphate of lime is very slightly soluble in water, and so is bi-tartrate of potash; and it is contrary to the usual theory of chemical combination to suppose that the constituents of these two salts would separate and re-combine as sulphate of potash, which is more soluble than either, unless the tartrate of lime which must be formed were absolutely insoluble and at once precipitated.

If this were the result of mixing sulphate of lime and bi-tartrate of potash in wine, the same result would ensue if bi-tartrate of potash were added to hard water, which contains salts of lime, and the water would be clouded and softened, which is not the case.

Again, as to the chemical effect in the body, would Mr. M. Williams explain on what authority he asserts that sulphate of potash or sulphuric acid is a precipitant of lithic acid? The analysis given in Miller's "Chemistry" shows that they exist together in solution. If it did precipitate uric acid, the sulphate of lime in hard water and the sulphate of soda in Carlsbad water would have the same effect.

It seems to be a dangerous doctrine to say port is less productive of gout than a dry sherry, because the latter may contain a trace of gypsum, and I think the opinion of Dr. H. Dobell, in "Diet and Regimen," and that expressed in "From Vineyard to Decanter," by Don Pedro Verdad, as to its harmlessness, is more reliable.

GYPSUM.

IS GYPSUM IN BEER INJURIOUS?

[1516]—At the recent Brewers' Exhibition, large quantities of prepared gypsum, warranted "to dissolve freely in water," were exposed for sale. It seems that brewers cannot make good beer except with hard water, and that the hardness produced by gypsum is preferable to that produced by chalk. Possibly this addition is not so injurious in beer as in wine, but I think we should all like to hear Mr. W. Mattieu Williams's opinion on the subject.

JOHN J. SCARGILL.

PREVISION IN A DREAM.

[1517]—Many years ago I had just joined the East India College, Haileybury, in the winter term, and, the morning after my arrival, was seated at breakfast with a friend—another freshman. I told him I had had one of my curious dreams the previous night, and I said: "I know there must be a cricket pavilion here with a verandah round it, for I dreamed that you and I were sitting in the verandah watching a match. Two men were standing in front of us talking; one of them was tall and dark, and the other was short, with red, curly hair. The former said so-and-so to the latter, and addressed him as 'Stumpwich.' Was not that a queer name? The actual name was not this, but it was one quite as odd and unmeaning." Next day we were again in my room when I saw a man crossing the quad, and I pointed him out to my friend, saying: "That is the man who was called 'Stumpwich'; let us find out if

that is his name." Other things put this matter out of our heads, and we forgot all about it. However, one day during the summer term following, my friend and I were seated in the verandah of the cricket pavilion watching a match, and two men—who, of course, we knew then—were talking in front of us. As soon as they began to converse I clutched hold of my friend and said: "Now, listen! You remember what I told you the first day last term?" The conversation we listened to was not apropos of anything in particular, but it seemed all quite familiar to me; and the tall man addressed the man with curly red hair as "Stumpwich"—which, in fact, was not his name, but his nickname. Now, I could not have known anything of this before I dreamt it. There was no significance attached to it; but I have a witness now living who can prove that this prophetic dream was not an hallucination.—Yours faithfully, H. B. L.

NO MATTER!

[1518]—Is the materialistic theory necessarily true? Matter is said to be composed of atoms—some say atoms of one kind only—others, atoms of hydrogen, oxygen, &c. In any case, these atoms never alter. An atom of hydrogen in a glass of water to-day was an atom of hydrogen in the primeval nebula. Combinations of atoms form molecules. Groups of molecules form solid liquid or gaseous matter, according to circumstances. Different arrangements of atoms produce different kinds of matter, but the atom never alters. Can an atom which never alters have any potentiality? There is no growth in the atom. No power of evolution in itself. To say all atoms are mutually attracted or mutually repelled is not true. The power, therefore, which arranges the atoms is outside them. That no two atoms touch one another may be taken as an axiom. But the distance between them may be great or small; our senses cannot perceive it so long as it remains relatively the same in all matter. At one time it may be many miles, at another but a few inches. So with time. Time may be composed of small periods. In fact, the only rational conception of continuous time is a number of small periods following one another. So again with motion. How does an atom get from one place to another? We can only imagine it in one place one moment and in another the next. It is not, therefore, an irrational conclusion to come to that the universe is carried on by a system of destructions and creations of matter. If so, the periods between the destructions and re-creations may vary in length without our senses being aware of it, and the terms "cause and effect" would have to be substituted by "antecedent and consequence." The cause would be outside. What that cause is is a matter of speculation. It may be the will of a single Deity, or of several demons, or of gods, demons, and human beings working harmoniously or otherwise. All I ask is, Is not the theory as probable as the purely materialistic one, which results in a continuous cycle of endless eras, exactly alike? During the last ten years *scientific* and *materialistic* have become too nearly convertible terms. It is to the advantage of neither science nor materialism. Jos. W. Alexander.

THE FAST OF TABERNACLES.

[1519]—Apropos of your editorial note (Vol. V., p. 272) wherein you express surprise that the Christian Church, though still celebrating the Passover, should "somehow have gotten rid of that particular fast" (of Tabernacles), it may interest you to know that we in Scotland still (as I believe) retain its equivalent.

Until within quite recent years the Church of Scotland celebrated the Holy Communion only twice a year, in spring and autumn; and in the great majority of parishes that is still the case. Previous to the "Sacrament Sunday," a day was (and still is) appointed to be "a day of solemn fasting, humiliation, and prayer." There is reason to believe that these "Fast-days," as they are termed, are much older than the Reformation.

Can you account for their being fixed for "the Thursday (in some parts Wednesday) before the last Friday" in April and October, instead of in *March* and *September*. Curious.

CHILDREN'S DRESS.

[1520]—About two years ago you favoured me by inserting in your valuable Knowledge a letter on children's dress. I venture again to call the attention of your readers to this subject, for I do not think that the reform is gaining ground as quickly as it should, notwithstanding lectures, dress associations, and exhibitions.

I find all my Liberal friends most conservative in dress, and, although my personal demonstration of the good resulting from our reform convinces them that we are right, they will not (exceptions are so few) act upon their convictions. We may hope, perhaps, that the introduction of Dr. Jaeger's sanitary system of woollen clothing will do much to aid our cause. I am myself deriving great benefit from the adoption of the *all woollen materials*, even to sleeping in blankets, discarding linen and calico sheets altogether; and I do feel that if mothers would just read the little book on "Health Culture" (by Dr. Jaeger), that they would, for the comfort and well-being of their nursery inmates, at any rate, adopt the principles of clothing therein advocated, and maybe they would themselves become converts to what is rational, comfortable, and healthful in the fashion of dress.

Fearing to trespass on your limited space, I abstain from further remarks, hoping the above suggestion, as a flying thought, may stimulate some one to try the innovation. E. Phillips.

THE SAMIAN TUNNEL.

[1521]—In No. 157 you reprint from *Iron* the account of the re-discovery of this ancient monument. (Reading Herodotus straight through for the first time I came on his account of it just after reading your extract.) It seems to me especially valuable as a test of the correctness of our ideas of ancient measures. (Herodotus (iii. 60) says its length was 7 stadia = 4,245 ft. *Iron* says about 5,000. Height and breadth 8 ft.; *Iron*, 5½ × 6. Canal, depth 20 cubits; *Iron*, about 5 ft. Width, 3 ft.; *Iron*, *nearly* 3 ft. The Greek foot was one-eighth of an inch longer than ours.

There were different kinds of cubits, but it is reasonable to suppose that the Samian cubit is here meant. Now, it was 18¼ in. —20 ∴ = 30 ft. 5 in. The other cubits were *greater* than the Samian. How can this enormous discrepancy be explained? Is it possible that only one-sixth of the canal has been dug out? That seems improbable, because the pipes have been discovered *in situ*. It seems more likely that Herodotus, generally so exact, misunderstood the figure.

By the way, he says nothing to lead us to suppose it "a work of the 10th century B.C." He mentions it after stories about Cambyses, Polycrates, and Periander, all late in the 6th century B.C.; but there is no reason to suppose it was constructed then.

Is not the "peaked arch" of bricks a hitherto unknown feature in Greek architecture?

He says the mountain was 300 yards high, and mentions the pipes without detail. Hallyards.

FOSSIL AND MODERN EYES.

[1522]—Neither you nor any correspondent proposes a reason for the contrast I remarked between the general size of eyes in the elder fossil animals, from the Palæozoic strata up to the Oolite, and the very reduced eyes of all later times; and so I will, as promised, suggest one. My notion is that the large-eyed creatures may probably have flourished in the days before there was a sun.

You must be well aware how essential a point it is of the Kantian or Laplace cosmogony now in vogue that the sun has to be held younger, by vast ages, than any of his planets. The smallest bodies are assumed to have condensed the first; and our earth, however diminutive among them, is the biggest body that we have yet, remember, any ground for supposing partly solidified. Very much of her crust, and even of her ocean, she must have had for long ages before our day-star became aught more than a diffuse nebula, somewhat like that in Andromeda. Calculate the light that the brightest such nebula would yield us, if subtending an oval, say of 20° by 40°—which, at the sun's distance, would imply it to occupy about 200,000 times his present bulk—and you will find it but a small fraction of our present daylight; though it may have radiated far more heat. Now, in process of ages, a time came that this great fire-mist shrank down into its present compactness, within its enclosing bubble of metallic liquids, and with its brilliant photosphere. Then, for the first time, did the other planets, previously invisible here, and our moon, visible only as a black spot transiting by day, become lights at night. And then, I suppose, the big eyes of ichthyosauri, &c., no longer being needed or advantageous, those creatures were superseded by such as the iguanodon, &c., with eyes on no bigger a scale than the animals of to-day have. E. L. Garbett.

Nov. 17, 1884.

[I fear that, in popular parlance, Mr. Garbett's theory "will not hold water." The eyes of the trilobites differ in no material respect from those of the recent dragon-fly, while those of the Silurian crustacea generally, the fish of the old red sandstone, &c., are certainly not abnormally large. Moreover, it is not easy to see how the superabundant Carboniferous flora can have flourished without sunlight, dimmed as it may possibly have been by large

quantities of vapour; while that the abundant Jurassic fauna could have existed by the light of a diffuse nebula will meet with scant credence indeed among zoologists.—Ed.]

A PROPERTY OF CERTAIN NUMBERS.

[1523]—Let n be any number prime to 10; that is, any number whose unit figure is 1, 3, 7, or 9.

Work out the decimal equivalent of $\frac{1}{n}$.

Let A represent the first figure, a the remainder; B the second figure, b the remainder; and so on. Finally, we shall get a figure (say N) giving 1 as remainder. Clearly the decimal will *recur* after N.

Thus, $$\frac{1}{n} = .\dot{A}\,B\,C\,D \ldots\ldots \dot{N},$$

And the successive remainders are

$$a,\ b,\ c,\ d,\ \ldots\ldots\ 1.$$

Now, $$\frac{a}{n} = .\dot{B}\,C\,D \ldots\ldots N\dot{A}$$

(since $\frac{10\,a}{n}$ gives B, and b remainder, &c.)

And the remainders are $b,\ c,\ d \ldots\ldots 1,\ a.$

Similarly, $$\frac{b}{n} = .\dot{C}\,D \ldots\ldots N\,A\,\dot{B},$$

with remainders $c,\ d \ldots\ldots 1,\ a,\ b.$

And so on, using each of the remainders in turn as multiplier. This is the whole mystery of the so-called figure puzzles 1398 and 1507, and of as many more as there are numbers prime to 10.

On referring to each of these "puzzles," it will be seen that in each case the multipliers are the *successive remainders* in working out the decimal equivalent of $\frac{1}{7}$ or $\frac{1}{13}$.

I have assumed that all numbers prime to 10 give *pure* recurring decimals. Readers may like to work out the proof of this for themselves. It is not difficult. W.

LETTERS RECEIVED AND SHORT ANSWERS.

K. K. Thanks for your offer, but we are so over-crowded that papers by members of our regular staff are now standing in type because no room can be found for them.—H. F. sends an account of the finding by a gentleman at Rurutoa, an island in the South Pacific, of a plate belonging to a Royal Mail steamer, no vessel of that company's fleet ever having sailed within thousands of miles of the place. Prior to this the brother of the finder, who was purser on board of the *Mexican* R.M.S., went down on that vessel; and the suggestion (for no proof is attempted) is that the plate *may* have belonged to the lost steamer. He also forwards an account of a Mrs. France, the wife of a betting-man in Button-street, Liverpool, who, the night before the Derby was run in 1867, dreamed that Hermit won it in a snowstorm—which, as a matter of fact, he did under those meteorological conditions. The "queer query" might more appropriately go to the *Family Herald*, or some similar paper. I cannot insert mere arithmetical puzzles.—E. W. Barton. I am glad that our Reviews and Inventors' Column please you so. Lectures, unfortunately, irrevocably at an end.—Romeike and Curtice. If you could see, for one brief five minutes, the torrent of matter showered upon the head of the unfortunate Editor of this paper, you would hardly expect him to subscribe for any addition to it in the shape of newspaper cuttings.—F. W. Rudler. Received with thanks.—H. Pilley. If you will look at a globe, you will see that hour circles all meet at the pole. Hence, the farther you go north or south of the equator, the slower any star or heavenly body seems to move in its path. Hence the reduction. I really cannot define cosine here. Buy Hunter's "Elements of Plane Trigonometry," in Gleig's School Series, published by Longmans. O P is got by simply joining O and P; directions being given for finding C O and C P.—Starch asks whether either of the years 1479 or 2992 indicate some great historical era? because, if so, the square in letter 1490 may owe its tremendous powers to the fact. He omits to say whether he refers to the years B.C., Anno Mundi, or what.—W. C. Gurley. Many thanks. It is both curious and interesting. The penumbra certainly arises from reflection from the back of the plate.—J. Murray. My *dear* sir, I know that it must be my own stupidity, I feel it painfully; but I cannot for the life of me make out how (even supposing, as you say, "a sudden change of temperature were to set in, and making everything vice versâ") our earth could ever become "as gentle at one end as it is severe at the other." I am equally unable to grasp the idea of temperature and the law of gravitation being "on one scale." While as for drawing "a right angle line through the perpendicular scale of knowledge" (!) I can't do it—I can't, indeed.—H. Edwards. Received.—R. Knight. Light, *per se*, exercises no repulsive influence. Heat is the operative factor in causing the vanes to move in the radiometer.—Samuel Kinns. The Conductor of this journal is not in England.—W. Your general proof will be utilised. In your hypercritical temper you quite ignore the fact that a concrete arithmetical example addresses and interests ten people for every one who cares about the formula whence it is derived.—J. Mercer. I believe that your method (which, by the way, seems to save little or no work) was described in a back volume of the *English Mechanic*. — Henry Peters. The game you describe has been a popular one in drawing-rooms any time during the last two or three years. Undoubtedly the operators, quite unconsciously and innocently, give indications of their wishes to the subject. Presumably you have read the published accounts of the performances of Mr. Stuart Cumberland, Mr. Edwyns, and Mr. Irving Bishop.—Sam Brook. The thing to which you refer was mentioned as a quasi-fraud. Even if I knew its composition I would not communicate it to anybody; but I do not, and do not want to do. See concluding paragraph (in capital letters) of those which head the Correspondence Column.—Nigel Doble. Your dream experiences are of a very common character.—Mark H. Judge. I entirely agree with you that the sooner the British Museum is opened during a portion, at all events, of Sunday, the better.—Henry George. Politics, equally with theology, are excluded from these columns.—James Gillespie. I will *not* write. The gentleman who says that Ursa Major was "right over head" in Australia in June, lies — under some terrible mistake. — Joseph Hudley. Received. — Anonymous. Thanks for kindly sending *The Christian Life*.—W. T. Burn Callander. I have received your "Morven," but, my goodness me! what does it all mean?—Anonymous. The question of Stores *v.* Retail Traders utterly foreign to our purpose.—W. A. says, apropos of letter 1503, that his son writes from the southern hemisphere that he has visited places which he had seen years ago in dreams. The coincidence in the case of his own dream is hardly sufficiently striking to deserve record.— John Gorham. A paper descriptive of your remarkably ingenious and efficient pupil-photometer will appear next week, containing the result of personal experiments with it.—H. A. L. S. Forgive me, I really have no space for sums whose solution may be found in every shilling elementary treatise on algebra ever published.—An Anonymous Correspondent sends me some newspaper cuttings commenting on the fact that, while the English "Fine Art Society" have been refused permission to photograph the pictures in the National Gallery, a German firm, called Braun & Co., have been permitted to do so. This affords but another illustration of the pure and lofty patriotism of Ralph Rackstraw, A.B. of H.M.S. *Pinafore*, who, "in spite of all temptations to belong to other nations, remains an Englishman."—Enquirer. See p. 235.—John Herbert asks Mr. T. Foster to inform him (in connection with "The Mystery of Edwin Drood"), first, whether the correspondence between Dickens and Miss Hogarth and Mr. Forster has been published or not? Secondly, Where the engravings were published which were reproduced on p. 401? Thirdly, What became of Drood's projected visit to Egypt? And fourthly, Why did the old Opium Woman follow Jasper down to Rochester? Mr. Foster is at this moment travelling abroad, but I am pretty sure that Knowledge is posted to him from the office, so that Mr. Herbert's queries will probably reach his eye sooner or later. The pictures appeared on the cover of the monthly numbers as issued. —J. A. Robson. Your first method is neither "legitimate nor reliable. Try another example with different figures (say an obtuse-angled triangle), and see where your formula will land you. There is no more simple geometrical method than your second. If you know the angles at the base of your triangle, it is needless to tell you that the side adjacent to either of such angles × its sine = perpendicular.—Benj. W. Austin. The conductor of this journal has been compelled to make a rigid rule to refuse his autograph; applications for it being too numerous for him to comply with.—Buxtona. It is, I think, very doubtful whether the papers by our contributor "Five of Clubs" will appear in a collected form before next year.—Engineer. It is a purely medical question, on which I am incompetent to form an opinion.—Dr. Groth. Your anger only tends to confirm my determination. I did not seek out your theory to attack or assail it gratuitously. You, as I understood, wished for my unbiassed opinion of it; and, preoccupied as I was, I actually read every word of your pamphlet before giving that opinion. Of course, it may be a case of Athanasius *contra mundum*. You may be right and all the rest of the world wrong, but then I am only one of the rest of the world.

Our Inventors' Column.

So great is the number of inventions now patented that many good things are comparatively lost in the crowd. A succinct account, therefore, by an Expert, of all inventions of really popular interest and utility must be advantageous both to the public and the Inventor, enabling persons to hear of inventions already desiderated by them, and thus acting reciprocally as a stimulant on supply and demand.

A NEW METHOD OF VENTILATION.

Although good ventilation is universally allowed to be the cardinal condition of a really sanitary house, few buildings, as a rule, are properly ventilated. Ventilation should be simple, as nearly automatic as practicable, and independent of mechanical aids. Mr. W. P. Buchan, sanitary engineer, 21, Renfrew-street, Glasgow, has invented what is known as Buchan's Patent Induced-Current Fixed Ventilator, which is in all ways unique. The ventilator normally has a square chamber in the body, the sides being perforated in the middle.

Opposite each perforated portion there is a metallic double baffle-plate, flat on the inside, but undulating or wave-lined on the outside, thickest in the middle, and tapering off on each side to a sharp edge. Between each two baffle-plates there is a vertical opening. The wind or horizontal air current, in rushing past and between the outside perpendicular plates and the body of the ventilator, draws out with it the air contained within the ventilator, and so causes an up current in the pipe or ventilating shaft upon which the ventilator is fixed. They are free to work with the slightest breath of air, and have shown the most favourable results in experiments made between them and other ventilators. From its construction the induced-current ventilator has not only a strong exhaust power when acted upon by the passing wind, but where there is an inclination to down-draught in the ventilating pipe, upon which it is fixed, this tendency is especially combated. These ventilators are all fixed, and are not liable to get out of order. They are made in a variety of styles, and to suit various purposes.

Mr. Buchan's ventilators and other sanitary appliances hold, we are told, the highest position in the market, being patronised by the Government Departments and the leading architects, physicians, and sanitarians in the kingdom. At Balmoral Castle, the Highland residence of her Majesty the Queen, his ventilators and traps are both in use, the style of the former harmonising remarkably well with the towers and turrets of the Castle.

NON-POISONOUS WATER-PIPES.

Popular science has at length pretty well convinced the public mind of the many perils incurred through defects, mechanical and otherwise, in our ordinary water-service. Messrs. Quirk, Barton, & Co., of 61, Gracechurch-street, E.C., have, by the invention of their patent tin-lined lead-piping, insured to all users thereof an absolute security against lead-poisoning. The piping in question is an improved medium for the supply of pure water to dwellings, affording absolute security from the danger of lead-poisoning. It consists of an inner pipe of pure block-tin encased by one of lead, the two metals being so united as to be inseparable by any contortion. The highest medical and scientific authorities report upon it, as the best and most advisable substitute for lead-pipe. The tin-lined sheet-lead has obviously the same recommendation for lining cisterns, &c., for storing water or other liquids for dietetic purposes.

A SMOKE PREVENTER.

An ingenious device has been patented by Mr. R. Wright Richmond, of Yorkshire, for entirely preventing smoke in any open fireplace. The means employed are simply a fine powder sprinkled on the fire by the agency of an improved kind of dredger. The powder is said to be composed of burned limestone and sea-coal compounded.

THE "UNIVERSITY" DUMB-BELL.

Now that personal hygiene is systematically studied in its muscular aspects by so many among us, an improved dumb-bell is likely to be in great popular demand. Messrs. Hardy & Padmore, of Worcester Foundry, Worcester, have introduced a new invention in this line known as the "University" Dumb-bell, which really supplies the users of dumb-bells with an article whose weight can be increased as the arms become stronger. To effect this end, the extremities of the dumb-bell are made hollow, and fitted with loose screw-caps; into these hollows weights of various diameters can be fitted, so that if one only is used, no noise is heard. The weights are half a pound each. These dumb-bells are well-balanced, and obviously one pair can be made to suit a whole household.

DR. SPENCER THOMPSON'S ORO-NASAL STEAM INHALER.

To those needing vapourised medicines, the substantial comfort of a really good inhaler can hardly be over-estimated. Dr. Spencer Thompson's oro-nasal inhaler is now being introduced into general use by Mr. W. Toogood, of Mount, St. Grosvenor-square, W., and is, *inter alia*, of an unusually elegant form for an inhaler. It is made in terra-cotta, and when nicely painted forms quite an ornament for a bracket or the mantelshelf. The lip of the inhaler is cut away so as to admit mouth and nose; and when filled with hot water, plain or medicated, with mouth and nose in proper position, and a handkerchief thrown round the crevices, it would be difficult to prevent all the air passages from being filled with the vapour, no exertion being needed to draw it to the desired spot. Inhalers are likely to be in demand this winter, and this one has much to commend it to popular use.

IMPROVED BOOT-LASTS.

There can be no question but that it is best, when possible, to have all boots and shoes made to order, and when once a good fit is thus obtained the use of the last renders this advantage permanent. A difficulty hitherto in the way has been the objection of bootmakers to give a small waist and heel with a broad tread, owing to the extreme trouble experienced in getting such a last out of the boot when the welt has been attached to the sole. In repairing boots, too, full-sized lasts cannot be used with certain classes of work. Messrs. Hartley, of 50, Abbey-road, Accrington, have now, however, patented a shoemakers' last and stand specially designed to remedy these defects. The lasts are divided vertically, or nearly so, and in such a manner as to lock themselves fast in when in use, in place of being, as heretofore, in one solid piece. Thus the separate pieces may be inserted in the boot or shoe separately, and removed by the agency of the usual last-hook. The frames are made to suit all sizes, and the patent swivel, self-locking, riveting, and finishing stand holds the last in any required position. This invention will be found a great advantage to those persons who desire to have boots or shoes made to order, and sometimes in a special manner.

MIDLOTHIAN OAT FLOUR.

Messrs. A. R. Scott, of 59, Crookston-street, Kingston, Glasgow, claim to have an important dietetic invention in what is known as Scott's Midlothian Oat Flour. The value of oatmeal is well known *per se*, and in this preparation both the husk and vegetable fibre are entirely removed, this beneficial process being effected by machinery of the most recent type, constructed with all the latest improvements, and with special attention to its adaptation to the production of the finest and purest quality of flour. To the elimination of the innutritious portions of the oatmeal, Messrs. Scott have devoted particular care, as may be inferred when we state that the result of a careful analysis made by Dr. William Wallace (the public analyst of Glasgow, Perth, Ayr, &c., and for the counties of Lanark, Renfrew and Sutherland), shows that the flour contains 80 per cent. more flesh and bone-forming properties than the finest oatmeal. This is a fact that is not generally known, but one that will not be lost on those who value health, especially in the cases of young growing children.

A TECHNICAL DRAWING APPARATUS.

Draughtsmanship is so much on the increase in these days of technics popularised, that many will be practically interested to know that a technical drawing apparatus, patented by Messrs. Cory & Barczinsky, is manufactured by Mr. W. H. Harling, 40, Hatton-garden, London, E.C. It is a combination of square, set squares of all angles, and protractor; and besides doing the work of each and all of these, it will divide circles or parts of circles into any number of equal parts without calculation. The instrument consists of a square (42 in. or 32 in.) with two stocks, one of which is fixed and the other movable. The blade of the square has two inverted grooves in which slides the dial. This dial, which is made of brass, is graduated into half-degrees, and is fitted with an indicator and arm, or ruler, also of brass (these latter in one piece, and so arranged that when the indicator shows a certain angle the ruler forms that angle with a perpendicular to the edge of the square), at the important angles, viz., 30°, 45°, 60°, 67½°, and 90°. There are special divisions near the edge into which a small knife fitted to the indicator drops and fixes it firmly, the degrees being read through an aperture in the end of the indicator. There is a small screw to lift the knife out of the division when the angle is wanted to be altered. This apparatus is made to divide circles into equal parts from two to thirty-two; but it can also be constructed so as to divide circles into more than 32 parts. The advantages of such an apparatus are sufficiently obvious.

Our Chess Column.

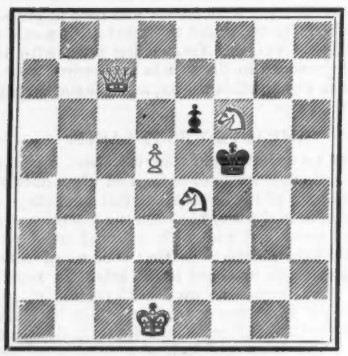
By Mephisto.

PROBLEM No. 137.

By J. B. (of Bridport).

(Selected.)

Black.



White.

White to play and mate in three moves.

SOLUTION.

Problem No. 135, by H. F. L. Meyer, p. 414.

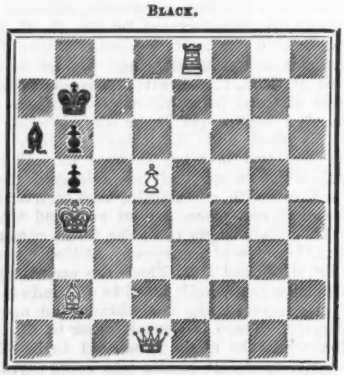
1. R to KKt sq.	K to Q6
2. R to R sq.	K to K5 or 7, B5 or 7
3. Q to QKt sq., Q sq., or KB sq. mate.	
1. (*a*)	K to B4
2. Kt to B2	P × Kt
3. P to Kt4 mate.	
1. (*b*)	P × R
2. Kt to B2 (ch)	Any
3. Q to R7 mate.	

In reference to this beautiful Problem and the remarks of "Clarence," a correspondent informs us that "Clarence" is not quite correct in stating that the above Problem is after Healey, though it is true that Meyer improved upon Healey's idea by substituting a move of the B for the R. The idea of No. 135 was worked out both by Lloyd and Thinkman in two separate problems, both of which, however, were incorrect. The following is the Problem:—

PROBLEM No. 138.

By H. F. L. Meyer.

Black.



White.

White to play and mate in three moves.

One of thirty simultaneous games played by Mr. Zukertort, at Bradford, on the 20th inst.:—

Ruy Lopez.

White. Mr. Macmaster.	Black. Mr. Zukertort.	White Mr. Macmaster.	Black Mr. Zukertort.
1. P to K4	P to K4	12. P to K5	Kt to Q2 (*a*)
2. Kt to KB3	Kt to QB3	13. P to Q4	P to B3
3. B to Kt5	Kt to B3	14. P to B4	Q to Kt3
4. P to Q3	B to B4	15. R to K sq.	P × P
5. Castles	Kt to Q5	16. P × P	P to B4 (*b*)
6. B to K3	P to B3	17. P to K6	Kt to B3
7. B × Kt	B × B	18. P to K7	R to K sq.
8. Kt × B	P × Kt	19. B × R	Kt × B
9. B to R4	Castles	20. R to KB sq.	Kt to B3
10. P to QB3	P × P	21. R × Kt	Resigns
11. Kt × P	P to Q4		

NOTES.

(*a*) Black had up to now the better game, but here he ought t have continued with 12. Kt to Kt5, and, after White's forced answer, P to Q4, 13. P to B3, &c.

(*b*) A blunder, which loses the game. White takes immediate advantage in very good style.

ANSWERS TO CORRESPONDENTS.

*** *Please address Chess Editor.*

Littlehampton.—See solution above.

S. B. C., J. J. Credlon, M. T. Hooton, R. Champ, and W. Furnival.—Solutions correct.

We hear that "John Bull's Neighbour in her True Light," which we reviewed on p. 75, is being translated into Russian, and will be issued in St. Petersburg at the beginning of the new year.

The Queen has forwarded, through General the Right Hon. Sir Henry F. Ponsonby, K.C.B., a present of books to the Bethnal Green Free Library. The books contain an inscription with her Majesty's signature.

Experiments have for some time been made in Belgium for preserving wood by exhausting the air from the pores and filling them with liquid gutta-percha. The gutta-percha is liquefied by mixing it with paraffin and subjecting it to heat. After it is introduced into the pores it hardens as it becomes cold.

Mr. Lowthian Bell has given figures showing that in the aggregate 156,499,000 tons of coal were brought to the surface in the United Kingdom in 1882, and that of this vast quantity 99,189,100 tons were applied to mechanical uses, while 57,309,800 were employed for heating only. The following table shows approximately the destination of the year's produce:—

Use.	Out of every 1,000 tons.	Total estimate of appliance —tons.
Paper-making and tanning	6	939,000
Copper, lead, tin, and zinc smelting	8	1,252,000
Waterworks	14	2,191,000
Breweries and distilleries	18	2,817,000
Chemical manufactories	19	2,973,000
Railways	20	3,130,000
Steam navigation	30	4,695,000
Clay, glass, and lime kilns	31	4,851,500
Textiles	42	6,573,000
Gasworks	60	9,390,000
Mining operations	67	10,485,500
Coal exported	92	14,398,000
Steam-engines	121	18,936,000
Iron and steel works	300	46,950,000
Domestic use	172	26,918,000
	1,000	156,499,000

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